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Saltykov Report on State of Russian S&T in 1993

947A0032A Moscow POISK in Russian No. 5 (247), 11-17 Feb 94 p 3

[Article under the rubric "The Portrait of a Problem": "Science Under the Dropper"—first paragraph is POISK introduction]

[Text] A meeting of the collegium, which was devoted to the tallying of the results of the work in 1993 and the specification of the tasks on the formulation and implementation of state scientific and technical policy during the year that has begun, was held in the Ministry of Science and Technical Policy of the Russian Federation. Let us acquaint the readers of POISK with the heads of the report of Minister Boris Saltykov and the conclusions, to which the collegium came after discussing the report.

The main goal of state policy in the sphere of science and technology is the preservation of the scientific and technical potential of Russia and its adaptation to the conditions of the market economy.

However, the achievement of this goal has been complicated by the real economic situation in the country, by the high inflation rate, by the budget deficit, by the aggravated political situation, and by the sweeping decrease of the demand for innovations, which has led to the intensification of the crises in the scientific and technical sphere.

The volume of direct contracts of enterprises with scientific organizations has decreased sharply, the share of exploratory research on the development of the necessary scientific and technical reserve in the total volume of work has declined. In particular, at scientific research institutes and design bureaus of machine building it decreased from 26 percent in 1991 to 0.8 percent in 1993. The quantity of completed research and development and produced prototypes of new equipment in machine building has decreased in the past three years by a factor of 11, about 60 percent of the scientific research institutes do not have an experimental base.

The building of science facilities, which were begun in previous years, has actually been halted. Pilot works and pilot plants, including unique ones that do not have analogs, are falling into disrepair due to the lack of assets for their maintenance.

The prestige of scientific labor has declined sharply, particularly due to the low wage, which in 1991 was 6.8 percent less and in November 1993, 38 percent less than the average for the national economy. The number of personnel of science and scientific service in 11 months of 1993 decreased by 350,000, or 13 percent.

Not only the personnel potential of Russian science, but also the possibilities of its reproduction are decreasing, since the share of graduates of higher educational institutions, who are linking their career with scientific work, is decreasing. As before the problem of the "brain drain" remains urgent. The representatives of the intellectual elite make up, according to the estimates of experts, only 5-10 percent of the number of specialists of the highest and intermediate skill. However, the loss of even one representative of the scientific and technological elite can be of importance for the development of the country and can do substantial harm.

The breaking of the established scientific and technical ties between the organizations and enterprises located on the territory of the former USSR is doing appreciable harm to the development of science and technology.

Due to the lack of currency the scale of international scientific cooperation has decreased noticeably. There is no opportunity to purchase abroad instruments, equipment, licenses, and scientific and technical publications.

The volumes of the publication of scientific and technical literature have declined significantly and the numbers of copies of it have decreased substantially due to the sharp increase of prices for paper and printing services. Given the overall sharp increase of the rates for electric and thermal power at a number of power-consuming institutes more than 60 percent of the budget assets, which are being allotted for scientific research, are being used to pay for energy resources. The situation with regard to communications services is similar.

The situation with the financing of research and development, the amounts of which (in comparable prices) have been decreasing annually, turned out to be particularly tense. Here it was carried out extremely unevenly and according to the remainder principle. In 1993 for the financing of science only 72.9 percent of the planned assets were allocated from the assets of the republic budget. The debt to science in 1993 reached 300 billion rubles [R]. The monthly principle of financing did not make it possible in 1993 to carry out full-fledged scientific activity and to conclude contracts with coperformers.

In spite of the difficult situation in the country, the scientific and technical potential of Russia remains very mighty. Much domestic research and development not only are competitive with respect to "western" research and development, but also lead the world level. Russia retains leadership, in particular, in the sphere of the ultra long-range transmission of AC and DC electric power of ultra-high voltage and in the development of individual types of ecologically clean power plants of large, intermediate, and small capacity.

However, the existing achievements are being assimilated slowly. For example, up to 30-40 percent of the developments of scientific organizations of the agricultural type are not finding use at all in production, while the genetic potential of strains and hybrids of agricultural crops and of breeds and lines of animals is being used at a level of not more than 60 percent.

In 1993 a number of steps of an economic organizational nature, which were aimed at moderating the effect of the crises on the scientific and technical sphere, were taken.

Among the most important of them are the steps on the concentration of a significant portion of the scientific potential and financial resources on priority directions of the development of science and technology.

The practical implementation of steps on the establishment of a network of state science centers of the Russian Federation was also begun. The financing of the scientific and technical programs of 42 centers, which are performing work in priority directions of science and technology, including in the area of theoretical and experimental physics, chemistry, biology and biotechnology, aeronautics, astronautics, shipbuilding, optics and electronics, medicine and individual sectors of machine building, was carried out.

In 1993, 41 state scientific and technical programs were implemented, of them the Ministry of Science and Technical Policy of Russia was the state client for 38. These programs included 250 directions, which envisage the development of new technologies, equipment and materials for the agroindustrial complex, medicine and health care, power engineering and transportation, mining and metallurgy and chemistry, construction and other sectors, as well as the development of research in promising directions. For the purposes of increasing the concentration of resources on the most effective and promising research and development work was begun on the review of the composition and list of projects of the programs on the basis of their independent examination.

The competitive selection of priority technologies and new types of products, which are ready for use starting in 1994-1995, was carried out. Their list was turned over to the Ministry of the Economy for implementation within the framework of state structural policy.

In 1993 the privatization of the scientific and technical sphere continued. However, the methods of privatization that are being used take insufficiently into account the specific nature of scientific and technical activity, which led at times to the disintegration of formed capable scientific complexes. In connection with this the drawing up of the draft of a decree of the government on privatization in the scientific and technical sphere, which takes its peculiarities into account, is being completed. For the successful implementation of scientific and technical policy a new system of financing, at the basis of which is the principle of the special-purpose financing of priority projects and programs with the systematic expansion of the practice of competitive financing, was proposed.

Attention should be directed to the fact that in recent times a number of important decisions on the stimulation of scientific and technical activity have been made. In particular, by the edict of the president of the Russian Federation of 22 December 1933 goods and technological equipment, which are imported to the Russian

Federation within the framework of free technical aid that is given for the conducting of joint scientific work, were exempt from the value-added tax [VAT]. The government approved lists of scientific research organizations, which are exempt from the fee for land and the property tax (846 scientific institutions were exempt from the property tax in the tax amount of R3.47 billion, 285 scientific institutions were submitted for exemption from the fee for land in the amount of R851.5 million).

For the purpose of increasing the social protection of scientists in 1993 the concept of the establishment of a nonstate pension fund for the personnel of science was formulated and its practical testing was carried out, a statute on pay for the academic degree of doctor and candidate of sciences was prepared and approved by the Ministry of Labor, and the draft of a decree on pay for the academic titles of corresponding members and academicians of sectorial academies of sciences, as well as proposals on common principles of the establishment of longer annual leaves for scientific personnel who have academic degrees were sent to the government.

Particular attention in 1993 was devoted to questions of cooperation with the regions. The Ministry of Science and Technical Policy of Russia formulated the concept of regional scientific and technical policy. Financing for the support of 70 regional scientific and technical programs and 47 projects was allotted on a matching basis from the republic budget. Assets from local sources were enlisted in the financing of these efforts. Interregional scientific and technical programs, of which the Siberia, Chernozem Zone, and Ural programs are the most prominent, were also implemented. The bulk of the programs and projects underwent examination through the Interdepartmental Council of the Ministry of Science and Technical Policy of Russia and the presidium of the Russian Academy of Sciences for regional scientific and technical policy and cooperation with the higher school.

In 1993 the work connected with the enlistment of foreign firms in the implementation of state scientific and technical programs was coordinated. Financial support was given to Russian scientific organizations that are performing work within the framework of 514 international scientific and technical projects.

A number of agreements on scientific and technical cooperation with countries of the CIS, including on the conducting of joint work in the area of welding, powder metallurgy and new ceramics and on laser technologies, were signed. A database on scientific facilities of joint use is being developed.

An intergovernmental agreement of the countries of the CIS on the interstate exchange of scientific and technical information, which is of great importance for the preservation of the formed information ties and the furnishing of collections with materials on the achievements of science and technology, was concluded.

Taking into account that the steps taken in 1993 in the area of science and technology do not encompass the

entire set of accumulated problems and on the basis of the government program of the development of reforms and the stabilization of the Russian economy, one should regard as the most important tasks for 1994:

- the concentration of state resources on the development of large science centers and the implementation of state scientific and technical programs which ensure the comprehensive solution of scientific and technical problems in the directions, in which domestic science holds leading positions, and the increase of the effectiveness of research and development and the work on the assimilation of new science-intensive products and technology;
- the development of basic research in the most promising directions and state support of the academic sector of science and enterprising scientific projects;
- the specification of a National List of Priority Directions of the Development of Science and Technology, as well as a list of state scientific and technical programs and key (critical) technologies as the basic guideline when spending assets of the federal budget on science;
- the completion of the preparation of proposals for submission to the government on the conferring of the status of State Science Centers, bearing in mind that the number of these centers should be limited;
- the specification of unique scientific facilities, which
  are liable to priority state support, as well as the
  making of an inspection of the formed network of
  budget-carried organizations of federal subordination
  for the purpose of determining the scientific organizations, which have a negligible scientific potential
  and are operating inefficiently, and settling the question of their retention as state scientific organizations;
- the formation and development of the market infrastructure and innovation activity, the establishment of effective mechanisms of the operation of science and technology parks, business and innovation centers, incubators of small innovation enterprises and other advanced forms of innovation activity;
- the privatization of facilities of the scientific and technical sphere with allowance for the necessity of ensuring in so doing the legal protection of objects of intellectual property;
- the improvement of the financing of science, including the establishment of a fixed fraction of allocations, which is envisaged in the federal budget for civilian research and development, the increase to 5 percent of the fraction of the deductions for the Russian Basic Research Fund, and the legalization of extrabudgetary research and development funds, which should become the basic source of financing of sectorial and intersectorial applied research and development;
- the stimulation of scientific and enterprising activity, including through the establishment of preferential rates for electric and thermal power for scientific institutions, the increase of the interest of enterprises in innovations by the granting of tax credits;
- the increase of the social protection of personnel of the sphere of science and technology;

- the development of cooperation with the regions in the area of science and technology, including questions of the choice of regional scientific and technical priorities, the formulation and implementation of regional scientific and technical programs, and their support with the use of a multiplicity of sources of financing:
- the improvement of international and interstate (with the countries of the CIS) cooperation;
- the preparation of legislative and legal acts that regulate relations in the scientific and technical sphere.

Having discussed the questions at hand, the collegium of the Russian Federation Ministry of Science and Technical Policy noted the vague delimitation of responsibility and spheres of activity in the scientific and technical area among federal executive bodies, between federal and regional organs of power, as well as their inadequate cooperation. This is one of the causes of the unjustified duplication of research and development, the inefficient use of financial and material resources, the inadequate cooperation and comprehensiveness in the solution of scientific and technical problems, and the lack in a number of cases of their orientation toward the end results. In practice the necessary unity in the formulation and pursuit of scientific and technical policy is absent.

The collegium considered it expedient to prepare suggestions on the improvement of the mechanism of the formulation and implementation of state scientific and technical policy, having in mind, in particular:

- the increase of the status of the Interdepartmental Coordinating Commission for Scientific and Technical Policy and its provision with real powers for the coordination and the elaboration of coordinated approaches of federal bodies of administration in the implementation of the unified state scientific and technical policy;
- the delimitation of the functions and spheres of responsibility of federal executive bodies in the scientific and technical area, the specification of their powers in the formulation and implementation of scientific and technical policy in the assigned area, as well as the delimitation of the functions in this sphere between federal and regional executive bodies;
- the assignment of the preparation of summary proposals on the pursuit of the unified state scientific and technical policy in the civilian sphere to the Ministry of Science and Technical Policy of Russia.

It was deemed necessary to increase the responsibility of deputies ministers, the chiefs of administrations, and specialists of the ministry for the timely and high-quality fulfillment of the tasks assigned to the Ministry of Science.

Russian Science Ministry Seminar on 'Brain Drain' 947A0032B Moscow POISK in Russian No. 7 (249), 25 Feb-3 Mar 94 p 3

[Article under the rubric "Portrait of a Problem": "The Experts Seek a Formula"—first paragraph is POISK introduction!

[Text] An international seminar devoted to the problem of the "brain drain" from Russia was held in Moscow on 21-23 February. The Russian Federation Ministry of Science and Technical Policy, the Committee for the Problem "The Brain Drain" under the Russian Federation Commission for UNESCO Affairs, and the Regional Office of Science and Technologies for Europe (UNESCO-ROSTE) organized it. The Russian and foreign experts discussed the draft of a report, which was prepared for this meeting. It will be submitted in the form, which has been worked out following evaluation by the experts, to the Government of the Russian Federation for decision making. Let us acquaint the readers of POISK with excepts from this document.

## Introduction: Science of Russia During the Transition Period

During the late 1980's and early 1990's a significant abrupt increase of emigration from the country was observed. This wave, which was due, on the one hand, to the intensifying socio-economic crisis of society and, on the other, to the liberalization of the policy of the regulation of departure, encompassed practically all social groups of the population of Russia, including intellectuals. It should be acknowledged that precisely the latter suffered to the greatest degree from the social consequences of the crisis, while the dire straits of science and the higher school of Russia under the conditions of the sharp decrease of budget allocations in 1992-1993 will undoubtedly provoke the intensification of the "brain drain" in the immediate future.

If the absolute figures of the departure of personnel from science remain at the 1991-1992 level, by 1990-2000 it will cease its existence in Russia. If the relative magnitude of departure remains, by 2000 in science the number of employees will come to about 700,000, that is, 25 percent of the 1992 level. Russian experts regard this version in case of the maintenance of the present course of reform in the country as most realistic.

The decrease of employment will be most significant in 1993-1995, then its pace will slow, and a certain personnel stabilization will occur. Thus, it is anticipated that the share of science by 2000 will decrease in the structure of employed people from 3.4 percent to 1 percent.

#### The Scale of the Migration of Scientific Personnel

The geography of external migration is rather broad, it encompasses practically all continents. However, an overwhelming portion of the emigrants are heading for four basic countries. Of the total number of people who left Russia before 1993, 45 percent of the emigrants went to Israel, 37 percent went to Germany, 12 percent went to the United States, and 2 percent went to Greece.

The flow of emigrants to the United States is characterized by the greatest "science-intensiveness." According to the 1992 data, among those who left 33 percent are people with a higher education and 44 percent are white collar workers. In three years (1990-1993) 4,500 scientists emigrated to the United States.

Along with this the emigration of Russian scientists to Third World countries, which in contrast to, for example, the United States and Germany are making a demand for scientific personnel of intermediate skill, increased appreciably. A big demand for Russian scientists, first of all for professors and instructors, exists in China. The arrival of about 1,000 Russian scientists in South Korea is anticipated. Iran and Iraq, which are interested first of all in importing specialists in the field of nuclear technologies and are prepared to pay them significantly more than the average annual salaries of nuclear physicists in the United States, are not concealing their interest in scientists from the CIS.

The process of the adaptation of Russian scientists to work in the West is not uniform. The scientific elite primarily gets jobs at universities and other scientific organizations, combining teaching activity with scientific pursuits. The results of a survey among mathematicians and theoretical physicists (96 doctors and 54 candidates of sciences, who work at scientific centers of the United States, Canada, Western Europe, and Australia) show that more than 70 percent of the surveyed scientists adapted easily to the new situation. The overwhelming majority of them (90 percent) believe that work abroad as a whole justified their expectations.

At the same time a large portion of the scientific personnel, who left Russia through the channels of ethnic emigration, were forced to leave the sphere of research and development, and this switch is of an irreversible nature. The share of "unlucky people," according to the data of the survey, came to 3-5 percent, but for emigre Russian scientists as a whole it is significantly higher.

In the opinion of 50 surveyed executives of leading foreign scientific centers, the problems of the adaptation of emigre Russian scientists are due to a poor knowledge of foreign languages (75 percent of the respondents), difficulties in dealings with colleagues (21 percent) and with students (67 percent), and the ignorance of foreign scientific literature (17 percent).

According to the data of a sample survey of the movement of personnel at 10 scientific research institutes of the capital (the total number of scientists is 3,746), which was conducted in 1992, in 10 months 1 percent of the scientific personnel (6.7 percent of all people who got their discharge) got their discharge from the surveyed institutes and went abroad, 60 percent of those who left are scientists up to the age of 40, 41 percent of those who

left had degrees, including 12 percent who had doctoral degrees. It is possible to regard an estimate of 1 percent as the maximum value of the indicator of scientific emigration from Russia during 1992. Here the share of foreign emigration in 1992 does not exceed 2 percent of the total departure of personnel from the sphere of research and development for other spheres of activity within Russia and migration about the territory of the former USSR. The share of those leaving, who worked in the sector "science and scientific education," as a whole for Russia during 1987-1992 came to 6 percent.

During a sociological survey that was conducted among 18 scientific institutes, 42 percent of the respondents indicated that they were pondering in earnest leaving for work abroad, although the opportunities for this for the present do not exist, 8 percent of the respondents intend to leave in the immediate future, and 5 percent of the respondents are considering the question of their going abroad because an opportunity for work abroad has personally appeared for them. Only 23 percent of the respondents are not considering the possibility of their going abroad.

Analyzing the prospects of the solution of this problem, 31 percent of those who responded to the question about the "brain drain" indicated that the factors, which are responsible for the departure of scientists from the country, are of a deep-seated nature and cannot be eliminated in the immediate future. The respondents assigned "the present state of society" to the overall cause of the difficulties that are being experienced by academic science.

As the second set of factors, which are responsible for the departure of scientists abroad, the respondents indicate the formed low level of prestige of science in society, the atmosphere of vulnerability and lack of protection, in which science has found itself, and the uncertainty for scientists of their future. Having a depressing effect on scientists is the lack of demand for their creativity abilities. Forty-six percent of the scientists believe that they are realizing their scientific potential fully, 31 percent believe that they are using only half of it, 13 percent believe that they are using it to a small degree.

The theme of the remuneration of the labor of scientific associates as one of the decisive factors, which is responsible for the "brain drain," is touched upon during the sociological surveys by nearly all the respondents. The absolute majority of scientists believe that it is necessary to raise the level of remuneration of scientific labor to international standards, having increased it by 10- to 30-fold. The changeover to a contract system in the conducting of research is suggested as the most important step in this direction.

In second place in importance is the underestimation by society of the social importance of intellectual labor (53 percent noted this as a reason for departure). Fifty percent rate nearly as highly the inadequate opportunities to realize oneself as a scientist in Russia. Forty percent of the

scientists, professors, and instructors of Moscow higher educational institutions noted the instability of the political situation and the threat of social disorders as a reason for leaving. Thirty-five percent of the respondents name as a reason for leaving anxiety over the fate of their children. Just as many respondents named as a reason for the emigration of scientists the overall deterioration of the economic situation and the threat of unemployment. Another 19 percent of the respondents noted as a reason for emigration the low level of protection of scientists and of the legal registration of the results of scientific activity.

The evaluations of the respondents, which were given during this survey, of the social and psychological factors that affect the decision of a scientist to go abroad, are also interesting. Eighty-four percent of the respondents named as such a factor the dissatisfaction with living conditions; 28 percent—the desire to conduct research in a stronger scientific collective; 26 percent—a young age; 22 percent—talent, a high intellectual potential; 13 percent—the existence of scientific contacts with foreign partners and scientific centers.

Among the fields of science, which have been particularly affected by emigration, one should name first of all mathematics and computer technology. In recent years the demand for programmers from Russia, first of all young people, has increased on the international labor market. The number of mathematicians leaving for the West today constitutes a significant share (25 percent) of the annual graduation of these specialists by elite faculties. The losses among physicists are also substantial.

Of course, the states, which are accepting our scientists, are interested in obtaining not "ballast," but the most talented, promising scientists who have created a name for themselves in science by great achievements.

As a result the most actively working, talented young people and middle-aged scientists, who have already achieved significant scientific results and are known through publications abroad, are leaving the country. A large portion of the scientists from the RAS, who have left for permanent residence abroad, have the degree of candidate (55.9 percent) and doctor (16.2 percent) of sciences. Nearly half (48.5 percent) of those who have left the country have not reached the age of 40.

As was noted, during 1990-1992 a significant decrease of the number of scientific personnel occurred. In 1993 this process continued, and in five months the number of scientific specialists of scientific and technical organizations (NTOs) decreased, according to the estimates of experts, by 7 percent, which makes it possible to predict an overall decrease during 1993 in the amount of 13-15 percent. This departure is objectively due to the redundancy of the market of scientific and technical labor, which finds its expression in the low level of the wage in science, periodic organized reductions of personnel, the narrowing of the possibilities for the conducting of work that interests the scientist and the specialist, and the stressful psychological atmosphere in scientific collectives.

Until recently inadequate attention was devoted to the analysis of this "internal migration," although in scale it is more significant than emigration beyond the country. According to the data of sample surveys of 1992 and 1993, there are 10-15 scientists, who left NTOs in search of better work, for each scientist who has emigrated.

What socio-economic consequences can such a pace and scale of migration have for Russia?

Under the influence of external and internal (intersectorial) migration the scientific and technical potential is weakening substantially, particularly with allowance made for the long-term consequences for the training of new generations of scientists and specialists. On a broader plane the country may lose the stratum of people, which is necessary for the maintenance in society of a balanced social strategy in the context of the chosen scientific and technical policy.

The country is undoubtedly incurring considerable material losses, which it spent on the training of specialists and scientific personnel. The calculations, which were made by the United Nations method (the subtraction from the gross national product of the direct and indirect outlays on the training of the personnel who leave and the lost gain from the activity of emigrants in this country) as of the beginning of 1991. show that in case of the departure of one specialist the country loses about \$300,000. If the forecast of the annual migration of the Ministry of the Economy of Russia—200,000-250,000 people annually—is confirmed, the country will annually lose \$60-75 billion.

#### The Problems of State Regulation of Intellectual Migration

Under present conditions the state cannot pose the task of not only the complete halt of the departure of scientists abroad, but also its significant reduction in the next few years. Attempts to complicate departure from the country by the creation of administrative barriers would be at variance with the legislation of Russia and with international obligations in the area of human rights.

The formulated draft of the Federal Program of the Regulation of Intellectual Migration is called upon to unite the efforts of state bodies and alternative structures, international organizations and foundations, and the scientific community in the interests of protecting the domestic intellectual potential.

The goals of the program are: the development of the principles and mechanisms of the long-term national policy of Russia in the area of the migration of scientists and specialists and the formation of a set of specific steps on the implementation of this policy; the reduction to a minimum of the harm from the departure abroad of the scientific and technical and the creative intelligentsia by the creation of adequate organizational legal and socio-economic working and living conditions of scientists and specialists in Russia and their effective participation in the international division of labor.

The development of a rational mechanism of the management of the process of intellectual migration and the creation of the conditions for its efficient operation are a most important task of the program.

The basic measures of the program can be implemented in three stage. At the first stage the task of preserving the scientific elite of Russia and of not allowing the leading scientific schools of the country to perish is advanced. At the same time it is necessary to place the process of the "brain drain" in a civilized framework. For these purposes it is planned to make efforts for the change of the form of migration from emigration without return (which still predominates) to temporary contract migration.

At the second (intermediate-term) stage a substantial change in connection with the changeover to a market of the structure of science, the forms and sources of its financing, and so on is proposed. Along with the state, the role of which will gradually decrease, independent structures, joint-stock companies, and various structures will become the clients of developments of scientists. The transformation of science in these directions creates favorable conditions for mutually advantageous cooperation with foreign scientific centers and firms, which produce science-intensive products. All this will make it possible to stabilize scientific research and development and then will ensure their development and growth, which will affect fundamentally the migration of intellectuals.

The third, long-range, stage of the regulation of intellectual migration can begin when Russia, having overcome the difficulties of the transition period, has formed a dynamic market economy and an efficiently functioning civilian society that makes a great demand for scientific ideas. This stage will afford real opportunities for the extensive return of emigre scientists to the homeland, as well as for the attraction of foreign scientists for work at Russian science centers.

The program is a state and long-term one and is approved by a decree of the government. The overall coordination of the work under the program is being carried out by the Russian Federation Ministry of Science and Technical Policy.

State participation in the financing of the program presumes:

- the allocation of budgetary funds for the development of science, culture, and higher education with allowance for potential aggravations of the problem of intellectual migration;
- the establishment of preferential conditions of taxation for enterprises and firms in case of the making by
  them of investments or the implementation of other
  projects that contribute to the achievement of the
  goals of the program;
- the mobilization of the assets being received from domestic and foreign nongovernmental organizations.

There should become the basic forces of the implementation of the program: first, government bodies, whose activity the Ministry of Science and Technical Policy of Russia coordinates; second, the scientific community, the public, and representatives of commercial structures and the mass media; third, international organizations and foundations, as well as the corresponding structures of the countries which are giving aid to Russian science; fourth, the appropriate subdivisions of the Federal Migration Service of Russia.

After the approval of the program at the state level a special subdivision (an administration or an agency for questions of intellectual migration), which performs the functions of the general management of the program, as well as an interdepartmental scientific council with the attraction of representatives of the scientific community, experts of international organizations, and so forth, which is responsible for the scientific, including research, support of the program are established within the Ministry of Science and Technical Policy.

The All-Russian Scientific Labor Exchange, which deals on a commercial basis with the entire set of questions connected with the support of the entire set of questions connected with the assurance of civilized conditions of the transfer of scientists and specialists.

The exchange in cooperation with the mass media (at the first stage the newspaper POISK) and other structures are publishing in Russian and English a special bulletin (the working name is SCIENCE EXCHANGE) with information on all questions that are important for the participants in the process of intellectual migration and for donor countries and recipient countries.

# Russian Academy of Sciences Victim of Own Failure to Reform

947A0035A Moscow KURANTY in Russian 3 Feb 94 p 7

[Article by Irina Lobacheva: "Far-Sighted Plato and Wise Keldysh, or How the Academy of Sciences is Trying to Survive Under the New Economic Conditions"; the first four paragraphs are an introduction]

[Text] An enormously long time has passed since the first academy made its appearance. Almost four centuries before the birth of Christ, about twenty centuries since the year 1 A.D. Precisely this time interval, almost inconceivable to the reasoning of an ordinary person, excuses anyone who has forgotten on what was based the Platonic Union, having as its purpose the honoring of the muses. I will therefore refresh your memory.

First Plato, who decided to gather scientific fellow thinkers and opponents around him, acquired (on his own resources)the gymnasia and the garden in which these academic institutions were located. To the point, the name of his academy was given in memory of the mythological hero Akademus, whose name was given to the garden purchased by Plato. Then students came to the gymnasia who spent their time both in philosophical

arguments and for exercises in mathematics, astronomy, natural science and other sciences. Probably in order to think better the academy members, that is, the academicists, voluntarily limited their sleep, refrained from carnal love and consumption of meat.

Our modern world organized its academies without having recourse to such self-tortures. And nevertheless the scientific associations traditionally bearing the name "academy" in most well-developed countries are usually striving to perpetuate the Platonic tradition. Existing on the resources of their own members as some councils of authorities recognized in the scientific world, to the extent which they are able they are endeavoring to support young scientists, are striving to inform mankind of scientific advances, are trying to ward off ecological catastrophes and are serving as experts when initiating and implementing scientific and technical programs capable of changing the life of the planet, etc., etc. Only Russia in its time has pursued a different course.

It is possible to understand Peter the Great, who himself, in essence, was the first Russian academician. The state took under its wing and gave state support to anyone who could contribute to the power of Russia. The scientist was no exception. And so it went—the Russian Academy always was supported from the public treasury. Academicians and professors, to be sure, were not rewarded with mountains of gold, but in general they lived rather comfortably.

The Soviet government demanded loyalty from scientists and in exchange offered the same support to all from the public treasury. Those who categorically rejected such conditions were banished or killed and those who remained were forced to accept the benefaction of the state.

Least of all do I want to accuse scientists of conformity. Yes, in the history of Soviet science there are very unpretty pages, but in the history of our country there are far more. But that is not at all what we are discussing here. Existing on the money of the Soviet state, Soviet science achieved more than a few successes, acknowledged as such by the entire civilized world. Under modern conditions, however pitiful it may be, all the most appreciable and fundamentally new scientific discoveries were made in fields in one way or another associated with defense. The military machine was swollen to the limit, requiring newer and newer specialists, newer and newer equipment. And together with it there also was an excessive increase in the number of scientific workers, institutes (for the most part closed and highly secret) and laboratories, scientific fields, themes, subthemes, minor themes simply being of some interest, those requiring the confirmation of ideas... And everything was funded virtually without restrictions.

As a result, in the prosperous year 1980, within the framework of the USSR Academy of Sciences alone, there were more than 250 scientific institutions at which

about 42,000 scientific specialists, 269 academicians and 536 corresponding members worked. So-called applied science (scientific research institutes operating under the departments, ministries, branch academies and institutions of higher education) increased these figures threefold as a minimum. The selected state form of organization of science remained patriarchal and unchangeable. It was born from the entire structure of economic control, it was centralized to the limit, was militarized, in essence ignoring the very concept of efficiency, and was closely linked to it. The economy went on the skids, and science went with it. This fact, however, exerted almost no influence on the financial position of either scientific workers or scientific institutions. Academicians received 500 rubles monthly for life and corresponding members received 350. An effort was made not to admit the unworthy to this steady, ensured life. Doctors and candidates of science routinely squabbled with one another, wangling funding for one research topic or another. Deathblows were inflicted on dozens in striving to live long enough to receive the pay of a junior scientific specialist...

And suddenly all this remained in the past. Including the detested trips to the vegetable commissaries. And a clearly designated day for receiving one's wages. And stable funding of a research topic over which a laboratory had already sweated for some years. And faith in a bright future, ensured by the mantle of the Academy. Well, to be sure, not many counted on achieving the rank of academician. But now virtually all were thunderstruck by the other innovations. And it got worse for everyone.

Despite the breakup of the country of which we all were citizens a few years ago, the number of representatives of science in Russia alone has considerably surpassed the figures cited two paragraphs above. The number of scientific institutions has increased to 445, about 61,000 scientific workers are now employed in their work force and there are 419 academicians and 594 corresponding members in the ranks of the Russian Academy of Sciences. And once again, as in the past example, the branch workers also considerably swell these figures. And it has become clear that the state is in no position to maintain this bulky and cumbersome structure.

Scientists must be given their due: some of them foresaw such a turn of events. Academician L. Keldysh, director of the Physics Institute of the Academy of Sciences, already two years ago in the VESTNIK [Herald] of the Academy of Sciences, published his prediction that the forms of organization of science prevailing in our country were impossible in any reasonable economy and he proposed his own program for the preservation of science and reorganization of the Academy. He directly raised questions concerning what kind of science was needed by a country experiencing hard times, whether society was in a position to support it and what had to be done in order to preserve fundamental science in a volume allowing the resurrection of the status of our country as one of the leading in the world. No one listened. Or did they not wish to listen?

The Academy has many other concerns. It is already the second month, for example, that its presidium has been busy trying to wangle the allocated budgeted sums for maintenance of the Academy from the Ministry of Finance. The money is coming, but with a great delay, and therefore is depreciated before reaching the pocket of the scientific specialist or the institute at which he works. The academicians are becoming nervous. As always in such cases, those responsible for the prevailing situation have already been found: these are the Ministries of Finance and Science and Technical Policy. The other day the list of the guilty parties was supplemented by still another department: the Ministry of Labor, which published an explanation of payment for the activity of scientific workers that did not fully satisfy the Academy, that is, its full members.

Do not hurry to take on faith the assertion by the Academy that the government is by plan destroying Russian science. Under very difficult conditions the state last year was able to allocate 130 billion rubles for maintaining the Academy (in the relatively prosperous year 1990 this sum was 1.9 billion). Is this a great sum? To be sure, it is inadequate. And although for each worker-and according to the personnel department, together with watchmen and mechanics there is a total of 138 402 people—almost a million rubles is allocated for the year, it must be understood that 30% of this money is "eaten up" by expenditures for electric power, water, heat and rent, and 60% is for salaries, true with a frightful lag, but nevertheless indexed. In actuality, no budgeted money remains for science. About 35 billion additional was received for carrying out scientific research from different funds and programs set up and managed under the patronage of the Ministry of Science and Technical Policy. The Academy is very nervous that these sums may be received only by winning in a competition. It has been the custom that the institutes receive money only from the hands of the presidium. And therefore the ministry is being accused of fine management, and in its place it is proposing its own services. With respect to distribution, naturally.

But meanwhile at the Academy institutes changes are nevertheless going on. Applications are being drawn up for grants from different funds; good possibilities are being afforded not only by the Soros Fund, but also by the Russian Fundamental Research Fund and by different foreign universities, and soon a Fund for Research in the Humanities and a Technological Fund will be in operation. For the time being all these apparent changes are on the initiative of the Ministry of Science and Technology. The Academy presidium, however, dispatching one letter after another to the president of the country, as before is asking for only one thing: money, money, money.

In December the salaries were increased for scientific workers under the budget. By a factor of 1.9. It is true that there are no funds for implementing this increase. But for the academicians not everything was clear: a presidential decree had stipulated life payments of 150,000 rubles for academicians and 75,000 for corresponding members. But, indeed, each of them already has an academic degree and therefore it was expected that the increased salaries would automatically be supplemented by a 50% increment for a doctoral degree. The Ministry of Labor, however, insists that the scientific degrees have already been allowed for in the salaries of the Academy elite. This has already been kicked around several times in the government and no one can make sense of who is right in this situation.

Somehow it is even awkward to tell about all this. Involuntarily one recalls: when during the past year the Soros Fund, taking into account the low wages of scientific workers, announced the possibility of payment of 500-dollar stipends and as a condition stipulated that the competitors have published works in publications authoritative in the scientific world during the last five years, only 23,000 such scientific workers were found in Russia. The Americans sent notifications of the awarding of the 500-dollar stipends to the home addresses of those receiving the awards, having evidently heard a lot about our academic customs. The presidium, however, has given no attention to the scandalous character of the situation—although it was high time to do so. It advanced from its ranks of servants of science candidates for the title "outstanding scientist" and "young talent." Now in the heart of the Academy institutes there are 5000 "outstanding scientists" who have been tapped for a 75,000-ruble scientific stipend and another thousand "young and talented" scientists designated by the state for a 50,000-ruble increment to their salary...

An infinite number of examples can be cited. When certain problems are solved new ones arise. A solution is found for some and others lie in v ait. And it is becoming clear that by cultivating the incomprehensible status of the Academy as some public-state structure, the problems of fundamental science, alas, are not being solved. It is the opinion of A. Shabad, co-chairman of the Academy's Electors Club, that the time has come to stop hiding one's head under the wing of undesignated state funding. The activity of the Academy must be directed into the juridical channel. If it is a public organization it should exist at the expense of its founders or sponsors. However, if it is a state organization it must be admitted that the state has the right to determine the priority purposeful programs and fund them with rigorous bookkeeping and oversight. And the illusions that it is possible to suffer through the tough times, just hang in, outwait the difficult times, while remaining in the former incomprehensible status, have no basis whatsoever.

It must be honestly acknowledged, as Academician Keldysh appealed for two years ago, that a rigid restriction must be placed on the number of research fields and projects supported by society, henceforth being oriented solely on first-class undertakings and maintaining them at a level as close as possible to the world level. And nevertheless there is no money left over and in the immediate future there is evidently nowhere from which

it can come. Therefore scientific workers must not be fed the illusions of far-reaching changes. The meager wages (and at some institutes the salaries of old-timers do not exceed 25-40 thousand rubles) do not solve any problems but only aggravate them. It happens that some man of science within the walls of his own institute sees, perhaps on payday, the same pay that he earned long ago at a different place and for performing completely different obligations, and has to settle for it. It not rarely happens that so-called commercial activity, based on the equipment and carried out in the facilities belonging to an institute, inevitably results in the cutoff of work on scientific problems and the income supposedly received from such activity does not even cover payments for communal services. So is it worthwhile to continue the agony?

Evidently the time has come for a return of science to the walls of the universities (not the numerous newcomers, but those where there are recognized scientific schools). There is nothing unusual in this—in the world there are exceedingly few examples of scientific pursuits which are detached from university centers. And without dragging it out, there should be an expert evaluation of all scientific projects, making it possible to bring together in scientific centers those who are capable of doing this. Many far-sighted scientific directors, incidentally, are already doing this. But the academicians, evidently, must be guided by Platonic principles of organization of scientific cooperation. So it has come about that Peter the Great's model has come to an end. Possibly the desire of Academician Keldysh not to remain in the position of academician-secretary of one of the academy departments can be considered a first step in this direction? In this way he decided to protest against an unreasonable form of organization of science, feeling that any attempt at artificially prolonging its existence will have sorrowful consequences for science. Possibly it is necessary to trust his instinct in this case as well?

# Russian Gold Technology More Easily Sold Abroad Than at Home

947A0035B Moscow ROSSIYSKIYE VESTI in Russian 10 Mar 94 p 3

[Article by Nikolay Myakinnik: "The 'Gold Reserve' of Russia is Not Only the Gold Itself, but Also Highly Productive Russian Technologies. Why Then Are We Striving, as Usual, to Let the West Take Them Over?"]

[Text] There's talk going around about the slimming down of the Russian gold reserve. Be that as it may, it can be rather rapidly supplemented if the government would finally show some interest in the fate of our country's competitive technologies for the production of gold from its raw materials. Otherwise the know-how and inventions associated with them may become the booty of the nouveau riche and without hindrance will turn up abroad. The time has come to acknowledge that these technologies also constitute a "gold reserve" of

Russia, strengthening its national economic security. It cannot be allowed that they share the fate of the nonferrous and rare metals which have floated abroad together with dollar earnings already exceeding 20 billion rubles.

An obvious paradox of our time: the results of the scientific and technical activity of our country's scientists are being introduced in many regions of the world, but in Russia itself they either remain unused or are not used at the proper level. A fashionable variant of solution of economic, technical or other problems is becoming the turning sometimes not to the best, but only to foreign experience. The country may be seized by a sort of foreign far-sightedness in which we remain oblivious to our own scientific "gold placers."

In a letter to the editor from Valeriy Golovin, entitled "Gold in Waste Heaps," published in ROSSIYSKIYE VESTI on 9 December 1993, he reported that the Mnogovershinnnyy Mineral Enrichment Combine in the Amur region when extracting gold and silver from ore on a regular basis dispatches to waste heaps up to 15% of the gold and up to 78% of the silver. As it was asserted in the publication, the lack of Russian technologies does not make possible the undertaking of any intensive exploitation of the Khakandzhin gold and silver deposit. The administration of Khabarovsk Kray links gold production plans for the immediate future only to reliance on the experience of foreign specialists.

Thus, a formula for success in the economic rebirth of different regions in Russia, seemingly attainable only by the use of foreign technologies, is being defined. But, truly, such a point of view can scarcely be elevated to the rank of a state policy. However, only those who are wearing the blinds of pro-Western far-sightedness fail to note that foreign companies usually offer for sale technologies which, to put it mildly, are of no economic value for their own countries.

However, the enormous interest which some foreign companies, unlike national producers, are manifesting in our competitive technologies, which in most cases until recently were kept completely secret, is logical. These technologies, understandably, can and must be an object of national pride, a truly golden Russian asset, the basis for the restoration of the national economy and civilized economic and scientific-technical cooperation with foreign countries.

One such technology was developed under the direction of Academician Boris Laskorin. This is a sorption leaching technology for extracting gold and silver from ores, the so-called "resin in pulp" method. Due to its universality and high efficiency it became the basis for developing technological schemes for the reworking of raw material containing gold from different deposits in the former USSR. Here the experience of production workers and the knowledge of the inventors of the technology were brought together.

Nowhere in the world is there raw material containing gold which is identical in its composition. And for this reason alone, even knowing the method itself, its optimum application is virtually impossible without the scientific-technical oversight of its inventors, a statement which can be made, however, relative to the use of any high technology. As is confirmed precisely by the situation prevailing at the Mnogovershinnyy Mineral Enrichment Combine, where the production workers through their own efforts probably could not accumulate that experience and knowledge which would be adequate for the optimum exploitation of the technology, which also evidently served as a reason for seeking assistance from abroad.

The many years of experience in using this technology confirms its high productive indices. For example, at the Muruntau gold production enterprise in the Kyzylkum alone, where the base technology with the participation of the inventors of the method was introduced as early as 1968, up to 94% of the gold is being extracted, and this in a deposit with an extremely low gold content. For richer ores the percentage of gold extraction is usually still higher.

In addition, a quarter century after its development the base technology is constantly being improved and has been perfected both in the laboratory and under commercial conditions at seven gold-producing enterprises in the former Soviet Union. The accumulated experience is unique and the new technological solutions are still protected as inventions.

Precisely Russian gold technology has opened the way to the production of gold from deposits regarded as poor, unsuited for commercial exploitation. After reexamining the conditions of gold and silver minerals, with allowance for use of the Boris Laskorin technology, the confirmed geological reserves of ore in gold-bearing deposits for their input into the economic cycle of the country increase in many cases by a factor of 10-12. Such deposits can be exploited at once, leaving for future generations the richer strategic geological gold and silver reserves.

Confirmation of the high competitiveness of our country's gold technology by foreign specialists became possible only after the stamp of secrecy was removed. The first publications on Russian technology for the complex reworking of gold-b aring raw material created broad interest throughout the world. When mineral exploiters became familiar with our method representatives of the leading companies of the gold-producing countries, that is, Great Britain, South Africa, United States, France and Brazil, as reported by Boris Laskorin, all gave the highest marks to the "resin in pulp" technology. To be sure, however, our know-how remained for them a commercial secret.

In turn, as long as this Russian method remained a secret foreign specialists used a different technology—the socalled "charcoal in pulp" method. A technical-economic comparison shows that the advantages of the "resin in pulp" method are indisputable in all respects: gold extraction is increased by 5-12%, the expenditure of costly reagents, the time required for processing the raw material, amount of engineering equipment and consumption of electric power are all reduced. The capital expenditures on the construction of a plant also are considerably lower.

The leading gold producing companies in the world, being guided by the obvious economic advantages from use of the competitive Russian technology, are intelligently acquiring it, even giving up their own ambitions. Our technology, for example, already is being exploited by the British Lonro company in Zimbabwe; the national JCI company in South Africa also is close to this, in a contract with which the Ministry of Atomic Energy of the Russian Federation there is a provision for commercialization of the rights of the inventors of this technology as being intellectual property (know-how and inventions). A number of key gold producing companies of other foreign countries also are interested in economic cooperation and in these countries through the Soyuzpatent Patent Attorneys Association juridical protection of this technology is being ensured and the patent office in South Africa has issued a patent for it: a document giving exclusive rights to Russia in the territory of South Africa.

It is possible, to be sure, not to analyze and not to take note of this problem, but simply put in the hands of the market economy, which sooner or later will put everything in its place. But, possibly is necessary that the interested federal control agencies in the Russian Federation pay heed to the prevailing situation with the use of high competitive technologies both in Russia and in the CIS countries and attempt to organize such a state scientific-technical, economic (investment, tax) and juridical strategy for a breakthrough, the fundamental thesis of which should be the fact that the gold reserve of the country and competitive gold extraction technologies constitute an important factor in the economic rebirth of Russia and the preservation of its national economic security.

A radical solution of this problem will serve as a basis for an attentive comparative analysis of that which is of value both in our country and abroad. It also probably can assist in extinguishing the Russian debt to foreign countries, which according to recent data exceeded the 60-billion dollar mark, not to mention the difficulties associated with debts within the country. But since debts must be paid off even today, a solution also must be found at once.

#### **CHEMISTRY**

#### Identification of Mumiye With Spectroscopy

947M0035A St. Petersburg ZHUR.NAL PRIKLADNOY KHIMII in Russian Vol. 66, No. 7, Jul 93

[Article by N. N. Kazanova, R. A. Bulgakova, Ye. I. Kochetkova, and V. I. Stanko, Physical and Technical Problems Institute, Moscow; UDC547.9:543.424]

[Abstract] During the past decade mumiye (MOV) has attracted both practical and scientific interest as a substance having healing properties. A requirement for the successful use of this substance lies in the determination of its authenticity. Mumiye is a complex biologically active substance having 60-80 percent organic matter. Its structure has not yet been established, although it is known that the organic fraction contains low molecular components such as benzoic and hippuric acids and both oxy- and amino-acids, various oligomers (peptides, carbohydrates) polymers, proteins, polysaccharides, glycoproteins and their modifications, polyphenols, and others. The nature of the biological activity of this substance has not been determined and therefore its identification by content of biologically active components has thus far been avoided. Taking into account the extremely complex composition of mumiye and the lack of reliable information on the composition and nature of its biological activity, it is hypothesized that the most expedient way to resolve the problem of identification of this substance lies not in determining the quantitative content of individual components, but rather in some integrated physical chemical characterization of the substance as a whole, especially spectral. In the present work a systematic study was made of the infra-red spectra at 4000-400 cm<sup>-1</sup> of 50 standard samples of authentic natural mumiye from deposits in Southwestern and Eastern Pamir, Eastern and Central Kazakhstan, Altay, and Tuva. Spectral criteria were established for identification of mumiye as a unique substance having a complex composition. A method is proposed for determining the authenticity of this substance from recommended spectral criteria making it possible to reliably identify mumiye and distinguish it from possible surrogates. Figure 1: references 4 (Russian).

#### Filtration of Liquids in Fibrous Polymeric Materials—Magnetic Field Carriers

947M0036 Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: BIOLOGIYA in Russian No. 2, Apr-Jun 93 pp 207-208

[Article by L. S. Pinchuk, V. A. Goldade, and O. K. Kvon, Mechanics of Metal-Polymer Systems Institute, Gomel; Korean Institute of Science and Technology, Seoul; UDC532.546:621.318.1]

[Abstract] One of the most pressing problems in modern technology is cleaning working liquids from contamination. This problem cannot be resolved simply by pretreating the liquid, owing to the presence of abrasives, chiefly in the form of ferromagnetic particles. The latter cause wear and lower the efficacy of the systems. Analysis of the principles involved in the filtration of such liquids indicates that the most simple and effective solution to this problem lies in the use of fibrous filter materials which are also carriers of a magnetic field. However, the mechanism of filtering liquids have not yet been sufficiently studied. Similar materials have not been widely disseminated owing to the lack of an economically feasible technology for forming elastic fibers from magnetically hard materials. In the present work data are presented on the filtration characteristics of polymeric fibrous materials which are also sources of a constant magnetic field. The materials were formed from a polymer melt filled with a magnetic substance by drawing out fibers with the aid of a gas stream, fastening the fibers to a substrate with adhesive, and subsequently treating it in a magnetic field. A well known extrusionfiller technology for making sheet fibrous polymeric materials was ineffective. The filters were tested with a model working liquid consisting of a petroleum oil containing arizona dust (fine grained powder of known particle size distribution) and barium ferrite as artificial contaminants. Filtration characteristics were assayed by photometric analysis of the liquids. The tests showed that the filters cause only an insignificant drop in filtration pressure while performing an almost uniform degree of purification to the working liquid. Another area of effective application of fibrous magnetic filter materials lies in the treatment of industrial and municipal effluents. A feature of these systems is the significant concentration of iron-containing contaminants which cause direct and progressive corrosion and wear to equipment, buildings, etc. Figures 2; references 8: 6 Russian, 2 Western.

#### Purging Microquantities of Organochlorine Pesticides From Potable Water With Activated Charcoal Akant-Meso

947M0048A Kiev KHIMIYA I TEKHNOLOGIYA VODY in Russian Vol. 15, No. 9-10, Sep-Oct 93 pp 647-650

[Article by T. M. Tkachuk, A. M. Koganovskiy, M. N. Timoshenko, N. A. Klim nko, and V. I. Kofanov, Colloidal Chemistry and Hydrochemistry Institute, Kiev; UDC628.162]

[Abstract] Micro-quantities of organo-chlorine compounds in river water, often exceeding the maximum allowable concentration, ends up in drinking water, since communal water treatment facilities are not designed to remove them. A major portion of these organo-chlorine compounds originate from pesticides, even those which have not been used for several years since they gradually wash out from the ground water and enter the system. A secondary source of organo-chlorine compounds in potable water is side reactions of chlorine in water with aqueous humus and organic substances entering river water from ground water deposits. These include chloromethanes, polychlorophenols, and chlorophenolic

acid. Experience in France, Germany, England, and USA shows that the single most dependable means for eliminating organo-chlorine compounds from drinking water is filtration through an activated charcoal, such as Filtrasorb-200 (Calgon Corp.) or Chemviron (Belgium). Satisfactory results have been obtained from an anthracitic charcoal produced in Ukraine, Akant-Mezo, developed at the Colloidal Chemistry and Hydrochemistry Institute. In the present work data are presented on total specific surface, meso-pore specific surface, and distribution of specific mesopore surface at radius limits of 1-4 nm in activated charcoals used in water treatment, KAD, AG-3, AG-PR, activated anthracite AUA, Akant-Mezo, and Filtrasorbs 100-400. From all indications, Akant-Mezo meets the requirements for deep treatment of water. Filtration of clear river water and tap water contaminated with hexachlorocyclohexane in concentrations of 35-43 micrograms per liter through a 0.3 meter column of Akant-Mezo, lowered the hexachlorocyclohexane concentration 350-400 times. The residual concentration was ≤ 0.1 microgram per liter. This meets the most rigid European standards for PDK of organochlorine pesticides in drinking water. References 13: 4 Russian, 9 Western.

#### **CHEMICAL INDUSTRY**

# Modified Mold-Resistant Polyurethane Coatings for Radio-Electronics

947M0037A Moscow PLASTICHESKIYE MASSY in Russian No. 6, Jun 93 pp 7-8

[Article by V. I. Shcherbakov, N. Ye, Stolyarova, Z. N. Drinko, B. V. Myasnikov, and V. V. Simonov; UDC678.644.066:667.613.5:620.193.82]

[Abstract] Electronic components used in communications and information handling are vulnerable to attack by molds. Polyurethane coatings obtained by hardening of industrial varnishes are readily contaminated with mold spores, especially in warm and moist air. Tributyl tin is an effective fungicide and tin-organic compounds are used as hardeners of polyurethane varnishes. Taking this into account, industrial grade varnish UR- 231 was modified with small quantities of tributyltin dichloromaleanate (DKhMO). This substance was synthesized by addition of tributyltin oxide to dichloromaleic acid. It has two biologically active groupings (the tributylstannyl group and a halogen at the double bond), each acting in a different fungicidal mechanism. This combination could intensify the activity of the compound through a

synergistic effect. The LD<sub>50</sub> (acute oral toxicity for mice) is equal to 200 mg per kg of the pure substance. DMKhO, being a trialkyltin carboxylate, also acts as a hardener for polyurethane resins. On hardening, this fungicide also becomes part of the composition of a macromolecular coating and provides structural biocidal protection. Bench tests demonstrated that the compound has satisfactory adhesion and electrical insulating resistance (over 2 MOhrns at 500 volts) which meets the standard. The test results also showed that varnish UR-231 modified with 0.1 percent DMKhMO has improved service properties for radio-electronic components and extends their use to tropical conditions. References 4: 1 Russian, 3 Western.

# Effect of MoS<sub>2</sub> Content on Thermal Properties of Polyarylate DV

947M0037B Moscow PLASTICHESKIYE MASSY in Russian No. 6, Jun 93 pp 42-45

[Article by G. F. Zyuzina, N. K. Vinogradova, I. A. Gribova, A. P. Krasnov, L. P. Kazanskiy, and Yu. S. Simakov [deceased]; UDC678.724.32:678.046.32:536.6]

[Abstract] During pressure casting of filled polymeric compositions at high temperatures and mechanical stress, physical chemical processes may take place which could alter the properties of the end product. The degree of change to the end product is directly proportional to the intensity of the above processes. In order to obtain filled materials having optimum characteristics, such as anti-friction, for example, it is necessary to determine the amount of filler needed to provide the given properties to the material, taking to account the mutual effects of the system components during handling. In the present work a study was made of the effects of molybdenum sulfide content on the characteristics of polyarylate DV compositions (copolymer of diphenylolpropane and a mixture of iso- and terephthalic acids in the ratio 1:0.5:0.5). It was demonstrated that the thermal properties of pressure cast samples of polyarylate DV filled with MoS<sub>2</sub> vary with the filler content. Materials containing 15 percent MoS<sub>2</sub> have optimum properties as manifested in higher heat resistance of the ester bond in the polymer owing to the formation of a coordination bond between the carbonyl group and the MoS2, and an increase in the thermo-oxidative stability of the filler. Increasing the MoS<sub>2</sub> content to 25 percent or more activates the decomposition of the isopropylydine groups, making it possible to form grafted branched polymer structures. Figures 2; references 4: 3 Russian, 1 Western.

# Durable Ceramic From Aluminum Oxide and Zirconium Dioxide

947M0050A Moscow STEKLO I KERAMIKA in Russian No. 9-10, Sep-Oct 93 pp 25-30

[Article by Ye. S. Lukin, N. A. Popova, and N. I. Zdvizhkova, RKhTU imeni D. I. Mendeleyev; UDC666.762:539.4]

[Abstract] The achievements of recent research convincingly demonstrate that the possibilities for developing new ceramic materials having elevated service properties from oxides and their mixtures are far from being exhausted. Development of the theory of fritting, successes in powder technology, new technological solutions to the selection of modifying additives enhanced the development of theoretical foundations for directed synthesis of new ceramic materials having specific properties, improvements in existing technology and qualities of materials thereby significantly expanding the range of applications of ceramics. However, the problem of obtaining new high quality ceramic materials in domestic industry has not yet been fully solved, notwithstanding the need for developing a new generation of components. This situation results from the fact that oxide powders used for production of ceramics fail to meet modern requirements, since they are not uniform in particle size or shape and are aggregated and not evenly dispersed. Even with prolonged milling it is not possible to obtain powders with less than 1-2 microns particle size. Without special additives, it is not possible to make ceramics having controlled structures and optimal properties. Especially pressing is research on methods of preparing powders having a given degree of dispersion and the subsequent development of new types of ceramics from oxides having high service qualities, possible only through utilization of chemical methods of controlled preparation of powders and the use of special modifying additives. There is practically not a single type of high temperature oxide ceramic produced in our country that is directly suitable for fabricating high quality components. Research on the effect of powder structure on fritting, microstructure, and ceramic properties made it possible to formulate a so-called "ideal" powder for making ceramics having optimal properties: aggregate size must not exceed one tenth of a micron, and they must have a spherical shape, not stick together and increase in size with time, and the distribution of components must be uniform throughout the bulk and surface of the particles. Some small enterprises have emerged in recent years which have initiated production of dispersed powders of Al<sub>2</sub>O<sub>3</sub>, ZrO<sub>2</sub>, and mixtures of Al<sub>2</sub>O<sub>3</sub> with ZrO<sub>2</sub>. As a rule, these powders require additional milling, calcining, additives, and compacting. The technology of ceramics made from these powders is still at the research stage, costly, and not widely used. However, they are undoubtedly promising. A stable technology has been developed for making ceramics from partially stabilized zirconium dioxide from very pure powders using chemical precipitation, hydrostatic compression, and fritting in air at 1450-1550° C. Durability of these ceramics is 750-900 MPa. They are monolithic in

structure, less than one micron crystal size, and neartheoretical density. These ceramics consist of grains of a tetragonal solid solution, with the surfaces containing continuous thin-layered coatings of cubic solid solution. This inhibits crystal growth during fritting and enhances stability at high temperatures. The use of these unique ceramics could significantly improve the quality of components made from them. References 10: 7 Russian, 3 Western.

#### New Modification of Silicon Dioxide Obtained Under Shock-Wave Conditions

947M0050B Moscow STEKLO I KERAMIKA in Russian No. 9-10, Sep-Oct 93 p 42

[Article by A. N. Tsvigunov, A. V. Belyakov, L. V. Bachurin, A. S. Vlasov, B. V. Zakharov, B. S. Svetlov, and V. G. Khotin, RKhTU imeni D. I. Mendeleyev; UDC539.63:666.192.001.5]

[Abstract] Amorphous silicon dioxide grade ChDA (pure for analysis) was chosen as a research object in the development of structures intended for compaction by explosion of finely dispersed substances. The silicon dioxide was subjected to shock-wave treatment in steel and copper ampules containing an axially arranged charge of explosive. After the shock-wave treatment, the silicon dioxide was subjected to X-ray phase analysis and IR spectroscopy. The results demonstrated the existence of a new, previously unknown modification of silicon dioxide having a primitive cubic lattice (a = 7.78 angstroms). X-ray and IR data are presented. Figure 1; references 5: 2 Russian, 3 Western.

### Polyorganosiloxane Paint and Lacquer Materials

947M0038 Moscow LAKOKRASOCHNYYE MATERIALY I IKH PRIMENIYE in Russian No. 6, Nov-Dec 93 pp 3-4

[Article by A. M. Muzafarov, V. D. Myakushev, V. V. Kazakova, N. A. Tebeneyeva, O. B. Gorbatsevich, and Ye. A. Rebrov, Synthetic Polymers Institute; UDC667.6:621.792:678.84]

[Abstract] Hydrolytic copolycondensation of various organosilanes forms the basis for production of siliconorganic film formers for lacquers and enamels. Although this process has been used to produce an entire series of industrial paints varnishes, these products are somewhat inadequate in physical mechanical properties and resistance to organic solvents. These shortcomings are commonly overcome by modifying the silicon-organic film formers with organic polymers. Although this improves the physical mechanical properties, it also reduces the heat resistance of the products. Other ways to overcome this problem include improving structural ordering in the synthesized silicon-organic film formers by heterofunctional condensation of structurally organized oligomers, although this had limited success. In the present work a study was made of the synthesis of silicon-organic film formers using sodium oxyorganoalkoxysiloxanes.

These universal reagents provide a new level for ordering structural organization of oligomers. This new approach may be used to develop production of a new generation of silicon-organic film formers. Figures 2; references 8 (Russian).

#### Sorption of Copper Ions With VION KN-1 Chemosorption Fiber

947M0008A Mytishchi KHIMICHESKIYE VOLOKNA in Russian No. 5, Sep-Oct 93 pp 27-29

[Article by B. M. Kats, R. M. Dlubovskiy, L. M. Kutovaya, and I. V. Makarenko, Physics SRI at Odessa State University; UDC677.494.675:677.027.622]

[Abstract] A partial list of some of the uses of ionite fibers includes treatment of drinking water, leaching of valuable components from effluents, removal of pollutants from air and gases, and treating electroplating effluents. However, the published data on ionite fibers is not systematized and often has a qualified character. This is especially true in the case of treating drinking water, where several heavy metal ions may be present simultaneously. In the present work the quantitative characteristics of the adsorption of copper ions from aqueous solutions on VION KN-1 (sodium form) chemosorption fiber, and the sorption capacity of the fiber under both static and dynamic conditions were determined in the case of aqueous solutions containing also mixtures of copper, lead and manganese. Figures 2; references 7 (Russian).

#### New Technological Process for Production of Tire Cord and Its Equipment Design

947M0008B Mytishchi KHIMICHESKIYE VOLOKNA in Russian No. 5, Sep-Oct 93 pp 37-39

[Article by M. V. Bogdan, A. A. Grom, and A. F. Goncharenko, NPO "Khimtekstilmash," Chernigov; UDC677.021.12]

[Abstract] Tire cord is presently still being produced in the classical method which includes filament making, stretching and pre-twisting, twisting, and weaving. The stretching and twisting operations are carried out on t pe KV-III-250 KA twisting-stretching machines and on the single process KO-228 twisting machine. These obsolete. noisy, and difficult to maintain machines operate at low speeds not exceeding 177 meters per minute with 2.85 kg packets being produced. The NPO "Khimtekstilmash" and the Chernigov PO "Khimvolokno" developed a new process to produce single wound tire cord. The process includes four sequential operations: forming the filament, stretching, twisting, and weaving it. The stretching and twisting operations are carried out on new highoutput machines, winding-stretching machine NV-400-KT24M and twisting machine KD-600-IK. The new process turns out high strength single wound capron filament for production of grade 35KNTS-O tire cord. Figures 2.

#### Preparation of Sorption-Active Fibrous Materials To Maintain and Protect Environment and Their Properties

947M0008C Mytishchi KIIIMICHESKIYE VOLOKNA in Russian No. 5, Sep-Oct 93 pp 49-52

[Article by L. S. Galbraykh, T. V. Druzhinina, L. A. Nazarina, M. V. Abramov, G. A. Gabriyelyan, L. V. Gulina, and V. N. Korzun, Textile Academy, Moscow; UDC677.4- 96:541.183.12+677.529-96:541.183.12]

[Abstract] Sorption-active fibers and fabrics made from them play a special part in environmental control. This part is determined by the high sorption capability and rates in mass exchange and low hydro- and aerodynamic resistance of these materials. Graft polymerization of ionogenic monomers and chemical conversion of functional groups in grafted chains are the most common methods for preparing chemosorbing fibers. To prepare various types of such fibrous materials, graft polymerization of radicals to fibers having various chemical structures have been developed—hydrocellulose, polycaproamide with redox systems as ionogenic, and nonionogenic (acrylonitrile, glycidyl methacrylate). These methods make it possible to conduct graft polymerization with practically no homopolymer formation at high process rates and under ecologically clean conditions. Chemo-sorbing fibrous materials having ion exchange and complex forming properties were prepared by chemical conversion of functional groups (epoxy, nitrile) on grafted copolymers. In the present work a brief characterization of the results of using these fibers and fabrics made from them to resolve ecological problems in various areas is presented. Covered are fibers made from grafted cellulose and polycaproamide fibers containing hydrazide groups to adsorb heavy metal ions, the sorption activities of fabrics in respect to sulfur dioxide, sorbents for radionucleides, and sorption-active carbon fiber materials. The latter may be used to adsorb petroleum products from water. Figures 3; references 12: 11 Russian, 1 Western.

# Use of Terlon Fiber To Resolve Ecological Problems 947M0008D Mytishchi KHIMICHESKIYE VOLOKNA in Russian No. 5, Sep-Oct 93 pp 53-54

[Article by A. V. Volokhina, V. I. Ognev, I. K. Pronichkina, T. S. Sokolova, V. A. Kirillov, V. K. Kovalev, V. S. Morev, and G. V. Poroshin, VNIIPV, Mytishchi, Asbestos Textiles SRI; UDC[677.494.675:536.495]. 044.14]

[Abstract] The domestically produced high-strength and heat resistant fiber having the trade name "Terlon," as well as the well known Kevlar (USA) and Tvaron (Netherlands), is a para-aramide fiber. Terlon is as good as the foreign analogs in physical properties. At the present time Terlon is being produced on an experimental basis as a high-strength fiber, both long and short staple. Terlon is said to be superior to the Kevlar and Tvaron in having a lower (5-10 percent) density, higher bonding

strength to rubber for tire cord, and better fibrillation for making pulp. According to data from the Gorky Labor Hygiene and Occupation Disease SRI, Terlon polymer has no irritating, sensitizing, or fibrogenic action and therefore its maximum allowable concentration has been set at 10 mg per cubic meter (equivalent to inert dust). The present work lists the many places where Terlon fiber may be substituted to provide environmentally beneficial effects. For example it may be used in radial tires, as a reinforcement in conveyer belts (in place of steel), and in the manufacture of heat and fire resistant special clothing for welders, metallurgists, and firemen. Short staple fiber and pulp made of Terlon may also be used in place of asbestos in brake mechanisms, gaskets, and fillers. References 3 (Russian).

# Concerning Use of High Strength Aramide Fibers for Environmental Protection

947M0008E Mytishchi KHIMICHESKIYE VOLOKNA in Russian No. 5, Sep-Oct 93 pp 55-56

[Article by L. V. Avrorova, V. V. Gvozdev, and B. Sh. Dadasheva; UDC[677.494.675:536.495].004.14]

[Abstract] Under the leadership of Academician G. I. Kudryavtsev, the Scientific Production Association "Khimvolokno" developed the high strength aramide fibers SVM and Armos. Changes in industry made it possible to distribute these products and thereby resolve ecological problems. Aramide fibers have a unique complex of properties making them ecologically attractive. In addition to being strong and resilient, they are heat resistant at temperature intervals to 250-270° C, resist bending, and have good textile properties. These properties make them very promising for use as filtration materials, especially for hot gases. The cyclones used for this purpose until recently, are suitable only for prefiltering. In the present work the use of aramide fabric filters to treat hot gases to remove coal ash is discussed. Test results indicate that the new aramide materials are promising.

#### Carbon Fiber Sorbents From Pitch

947M0008F Mytishchi KHIMICHESKIYE VOLOKNA in Russian No. 5, Sep-Oct 93 p 56

[Article by V. Ya. Varshavskiy, M. A. Kozykina, and Ye. G. Monastyrskaya, NPP "Avtor", Mytishchi; UDC677.529-96:541.182.12]

[Abstract] The need to develop low cost carbon sorbents caused a rise in interest in the use carbon fibers made from pitch for this purpose. Compared to carbon fibers made from acrylonitrile or viscose, these fibers are made from a low cost and readily available source using an

effective fiber-forming method (from a melt) and an ecologically clean method of production of the carbon fiber at high (75-80 percent) product yield, and the possibility of developing a fully mechanized technological stream of high unit capacity. A simple and effective method for activating carbon fibers made from pitch has been developed under laboratory conditions. An experimental set-up, developed for studying the dynamic characteristics of the sorption process on activated fibers, was used to study the porosity of the fibers (pore volume, specific surface, and pore size distribution). Based on this study, the process was optimized for producing sorbent samples capable of sorbing up to 600 mg benzene per gram of fiber. Pore size of the samples did not exceed 35 Angstroms, the average being 10-15 Angstroms. The fiber has a strong activity towards both polar and non-polar substances: benzene, toluene, xylene, hexane, acetone, and ethyl cellosolve. The goal of further research will focus on the development of a technological process for activating carbonaceous materials made from pitch and its related equipment design.

#### Work Trends in Area of Preparation and Applications of Chemosorbing Fibers

947M0008G Mytishchi KHIMICHESKIYE VOLOKNA in Russian No. 5, Sep-Oct 93 pp 57-58

[Article by I. N. Illarionov and A. P. Komarov, Military Academy of Chemical Defense, Moscow; UDC677.4-96: 541.183.12]

[Abstract] Safeguarding the air and water media from harmful substances is a pressing problem, especially in regard to compounds of sulfur, nitrogen, chlorine, fluorine, and other toxic substances. Chemosorption on fibrous materials has evolved as the preferred method for removal of these substances. These fibers may be produced by: a) graft polymerization of active monomers capable of chemosorption to a finished monomer; b) forming a fiber from a copolymer containing chemically active groups; c) forming a fiber from a mixture of polymers containing chemosorbing groups. However, the output of these fibers by all known methods does not exceed several tons annually, and the immediate task consists of developing broad scale production of these materials in so far as experience indicates their undisputed advantages in resolving problems in safeguarding the environment. At the same time, the assortment of chemosorbent fibers should be broadened to include oxidation-reduction groups and groups capable of selective sorption. The report [sic] also discusses experimental data on the use of the chemosorptive fiber Vion for sorption of pollutants from industrial effluents. Results are presented on the testing of protective clothing which has good moisture and air breathing qualities, but is also impermeable to chemically active substances such as acids.

#### **MISCELLANEOUS**

Stereo Designed Crown-Compounds. Part II. Synthesis and Conformations of Trans-Cyclohexanodithiacrown Esters

947M0049A St. Petersburg ZHURNAL ORGANICHESKOY KHIMII in Russian Vol 29, No. 6, Jun 93 pp 1095-1100

[Article by V. V. Samoshin, Ya. A. Vereshchagina, A. I. Lutsenko, and N. S. Zefirov, Moscow State University imeni M. V. Lomonosov; UDC541.63+547.898]

[Abstract] Trans-cyclohexanocrown esters are macrocyclic ligands having complex-forming properties which can be regulated by introducing variously orientated substituents at the cyclohexane fragment of the molecule. The possibility of such regulating is due to the change in relative stability of the two conformers (A and B) during a change

in conformational energy of an alkyl substituent (R) in the molecule. The macrocycle in conformer B is much more susceptible to formation of complexes with cations than the extended macrocycle in conformer A. This has been confirmed experimentally: the addition of inorganic salts to solutions of the trans-cyclohexanocrown esters in CD<sub>3</sub>OD and (CD<sub>3</sub>)<sub>2</sub>CO results in an equilibrium shift in conformer IB. The regulating role of substituent R consists of destabilizing the IB-cation complex, which becomes intensified with an increase in conformational energy of the substituent. In the present work the transcyclohexanodithiocrown ester homologous series was synthesized from corresponding trans-1,2-cyclohexanodiols. The ratio of conformers to one another was determined by PMR from the synthesis products. It was demonstrated that the position of conformational equilibrium is determined by the size and structure of the macrocycle and by the volume of the substituent in the alicyclic fragment. References 11: 8 Russian, 3 Western.

Problem of Radiation Pulsations in Solid State Lasers

947J0018 St. Petersburg ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol. 63 No. 8, Aug 93 (manuscript received 23 Jun 92) pp 89-98

[Article by V. V. Antsiferov, Vekua Physicotechnical Institute]

[Abstract] Experimental results are presented from studies of spectral and temporal characteristics of chromium and neodymium ion laser radiation in various media. The author obtained the results in a number of experiments using one experimental setup and identical conditions. This was done to eliminate the effect of technical perturbations of the resonator. The qualitative difference in the behavior of the free generation of chromium and neodymium ions suggests a physical mechanism which causes nonattenuating radiation pulsations in lasers using ions with an external working shell linked with the spallation of the working levels of the ions in their own radiation field. It is unambiguously found that chromium ion lasers, in contrast to neodymium ion lasers, have a distinct

physical mechanism which causes nonattenuating pulsation of radiation intensity. Any mechanism associated with spatial interaction of modes in the active medium is ruled out. The difference in the lasers is ascribed to the great difference in the structure of the ions' working levels. The electric field of the laser radiation which arises in the active medium will affect only chromium ions, leading to further spallation of the working levels due to the dynamic Stark effect. When the field in the active medium is spatially inhomogeneous, a standing wave is formed whose spatial structure is altered during generation. The Stark effect leads to modulation of intensity over time and nonattenuating pulsations in intensity. When the spatial inhomogeneity of the field in the active medium is smoothed, this intensity modulation disappears. This conclusion was verified experimentally using titanium lasers. It may also be concluded that free generation of all rare earth ions in various media should occur in quasi-stationary mode without the need to smooth the spatial inhomogeneity of the field in the active medium. Figures 6; references 44, 33 Russian, 11 Western.

# Optimum Parallel Reallocations of Two-Dimensional Arrays

947G0015A Moscow PROGRAMMIROVANIYE in Russian No. 6, Nov-Dec 93 (manuscript received 17 Aug 92) pp 81-87

[Article by B.Ya. Shteynberg, Computer Center at Rostov University; UDC 681.124.2]

[Abstract] For optimizing the reallocation of twodimensional arrays in a supercomputer memory, algorithms are constructed which minimize the number of simultaneous data transfers for executing nests of cycles such as transposition of a matrix. The memory is assumed to consist of p segments so that p simultaneous data acquisitions or p simultaneous data retrievals are possible, program fragments being considered here which contain arrays with indices linearly dependent on the cycle counters I and J. The reallocation problem is thus reduced to synthesis of a parallel algorithm for fastest execution of the two-dimensional cycle DO 1 J = 0,N DO 1 I = 0,M 1 Y(I,J) = Y(I,J) = X(a\*I + b\*J + c, a1\*I + b1\*J + c1) involving two orthogonally disposed arrays Y and X. It must be kept in mind here that, unlike distribution of data, allocation of data does not indicate into which cell J of a memory segment a given array element I will move. The problem is solved for N= M= p-1 and two specific cases. The first case is a fully accessible commutator with p inputs and p outputs which can be connected to one another, the simplest one being such a commutator where at some instant of time one input can be connected to only one output, while simultaneously another input can be connected to another output. The second case is a ring network facilitating simultaneous transfers but only those which correspond to cyclic shifts, namely permutations of such that ( $\sigma_i$  mod p for any i,j in respective 1,...,p sets. The reallocation algorithms involve deparallelization of cycles and are validated by three lemmas: 1) when a,b,p are natural numbers, then there exists a number t such that GCD(a + t\*b,p)=GCD.(a,b,p)=1; 2) when a,b,c are integers, then t can be any number in the set of integers; 3) for any integers b and p there exist integers t and s such that t\*b + s\*p= GCD(b,p) and t is the reciprocal of p (GCD greatest common divisor). Following rigorous proofs of these lemmas, respective algorithms are applied to reallocation of an array in a multiprocessor computer system with either a universal commutator or with a ring network. Theorems are then proved, with the aid of an appropriate fourth lemma each, which define the least number of transfers necessary for simultaneously executing a nest of cycles DO 1 L = 0,p-1 1  $A(u^*I + v, uI^*I + vI) = B(a^*I + b, uI^*I + vI) = B(a^*I + vI) = B(a^*I + b, uI^*I + vI) = B(a^*I + vI) = B(a^*I$ a1\*I + b1) over a universal commutator and over ring network respectively. This number is p\*d in the first case with d = GCD(a,b,p) and p or  $p^2/q$  in the second case, q being the largest divisor of c/GCD(a,b,c)= GCD(a,b,c)/b and each transfer being a shift. Transposition of a twodimensional p-order matrix p in accordance with the

appropriate algorithm is demonstrated on a binary cycle DO 1 J = 0,p-1 DO 1 I= 0,p-1 1 Y(I,J) = X(J,I) equivalent to a DO 1 L = 0,p-1 DO 1 I = 0,p-1 1 Y((I,(I+L) mod p) = X((I+L) mod p,I) cycle. References 7.

#### FASTBUS 64-Bit Register with Buffer Memory

947G0015B Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No. 6, Nov-Dec 93 (manuscript received 5 Oct 92, after completion 7 Jul 93) pp 107-110

[Article by A.N. Parfenov, Joint Institute of Nuclear Research, Dubna; UDC 621.374.387]

[Abstract] An input register module in the FASTBUS standard has been developed for recording coordinates in a multichannel hodoscope and their subsequent transfer into a buffer memory, this 2x32-bit F65588 device being much faster and "deeper" than the existing F6585 4-bit shift register. The module built with K500 series microcircuits includes two differential receivers, two input registers, and two sequentially operating memories. The first register stores the leading edge of clock signal pulses and then transfers it to the Wememory, whereupon the second register stores the trailing edge of clock signal pulses and then transfers it to the C. memory. In this way the recording speed is doubled and the resolving time is halved. Both memories operate in the mode of data storing with the We and C, recording signals put in the constant resolving state by means of a reset signal coming from the front panel. Addressation is done in Gray codes by two corresponding binary counters, with subsequent recoding by means of exclusive OR logic and with a register on the output side which eliminates the possibility of data being sent to the wrong address during a change of address. A trigger signal indicates when an event takes place. The module includes also two delay counters, a remarkable feature thus being the possibility of presetting the time delay between that trigger signal and the beginning of data recording. In this way data can be recorded both before and after the trigger signal, which makes it possible to also record the "history" preceding an event. Readout of data from the FASTBUS trunk is effected by means of a 2x4 decoder with one input and four outputs, both memories having been partitioned into two segments each and a CSRO register generating an FB reset signal which is then combined in the OR mode with the reset signal from the front panel. Multiplexing of output signals is done by combining the respective memory outputs in the inclusive OR mode and by using the control inputs of the C, memory, to which resolving signals are sent by the decoder. The author thanks A.G. Litvinenko for helpful discussions and for evaluating the necessary parameters, also V.I. Maksimenkova and D.P. Mikhalev for assisting in assembly and adjustments of the module. Figures 2; references 2.

Main Results of Scientific Research Domby Institute of Radio Engineering and Electronics at Russian Academy of Sciences in 1984-92 Period: Lasers and Optical Systems (Including Fiber Optics, Methods and Devices, also Generation of Electromagnetic Signals)

974K0066A Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol. 38 No. 10, Oct 93

[Article by Ye.N. Bazarov and K.I. Palatov]

[Abstract] During the 1984-92 period the Institute of Radio Engineering and Electronics at the Russian Academy of Sciences intensified research in the field of quantum electronics, the three main areas being: 1) fiber-optics technology, 2) laser materials and devices, 3) spectroscopy based on nuclear-magnetic resonance or on luminescence.

In the first area have been for the first time developed: a) a method of extruding single-mode fibers with sheaths made of fluorine-doped quartz glass for 1.3-1.55 µm infrared light b) a new technology for producing anisotropic single-mode fibers which maintain the polarization and the intensity of light with minimal losses c) a laboratory technology for producing single-mode fibers which transmit 1.3 µm light with an only 0.7 dB/km maximum loss d) a method of welding together different fibers with an only 0.5 dB loss per joint. In addition to improvement of the extruding apparatus, there have been developed a plasmochemical variant of vertical lateral deposition for glass-forming oxides with use of organometallic compounds as initial reactants, a method of producing largeaperture fibers, a method of producing low-loss multimode fibers. A new method of forming anisotropic "bow tie" fibers, with the aid of thermal shields, has been proposed and demonstrated. A high magnetic susceptibility of single-mode fibers has been attained by use of using rare-earth elements as dopants. For the first time has been developed a tubeless method of lateral deposition of thin fluorosilicate sheaths on quartz rods in a microwave plasma. Jointly with the Institute of Optical Physics and the Scientific Research Institute of Electrical Systems at the Ministry of Electrical Industry have been produced radiation-resistant power fibers, radiation-resistant and mechanically strong single-mode and multimode fibers, thick fiber strands for optical cables, and large-aperture low-loss fibers doped with various rare-earth elements as well as large-aperture quartz-quartz fibers for transmitting up to 500 W of laser radiation power with 80% efficiency. Other developments include deposition of polymer sheaths, new silicon elastomers for fiber coatings which will ensure at least 99% transmission, and a cryogenic microcable for temperatures from 80°C down to -60°C. Theoretical studies have yielded a theory of microflexure and a new model of hydrolytic fracture of quartz fibers. New apparatus with fiber-optic components for measuring physical quantities and methods of doing it have also been developed, the components including fiber thermooptic channel switches, Fourier analyzers, a random-access memory, polarizers, light

modulators, two-mode reflectometers, directional couplers, temperature and magnetic field transducers. Work has furthermore been done on several practical applications of fiber-optic technology. In the area of laser materials and devices there have been developed a method of hardening phosphate glass, a new Cr-Y-Er glass for heatresistant minilasers and high-efficiency low- threshold quatrons, a 1.5 µm Er-minilaser suitable for a record high 7 Hz pulse repetition rate, borate glass activated with Yb and Er. There also have for the first time been achieved parametric resonance emission of ultraviolet picosecond pulses and continuous high-efficiency emission by Nd ions. Other new developments include powder lasers (Ndion implanted in powders of La oxide or oxysulfide, binary Na, La, Ba, or Gd chromate- molybdate, La-Sr niobate, and Ga-Yb sulfide with Nd impurity), a new kind of mirrors using resonant metal screens for optically pumped lasers, a highly long-time stable CO<sub>2</sub>-O<sub>5</sub>O<sub>4</sub>, and diffusely reflecting coatings (aluminum, fused quartz, phosphate glass) for laser reflectors, also a new method of hardening phosphate glass for active media and a new method of welding together glasses containing chromium. The feasibility of producing fibers for high-efficiency transmission of infrared light has been proposed on the basis of theoretical analysis and then demonstrated experimentally on fibers transmitting 1.5 µm at an average power of 2 W with an up to 30% efficiency. With low-energy ultraviolet lasers, efficient frequency conversion by stimulated Raman scattering has been achieved in a multipass vessel containing methane under a pressure of 30 atm. Research was done on both electron-magnetic resonance and nuclear- magnetic resonance spectroscopy, studies of the latter having revealed a "cascade" narrowing of the NMR spectra owing to concurrent action of a strong radio-frequency field and slow molecular movements in solids. As to generators of electromagnetic signals, there have been developed microminiature microwave vacuum devices including solidstate oscillators such as transistors, avalanche diodes, and Gunn-effect diodes. More than 80 scientific articles have been published during that period.

#### Two-Position Lightguide Optical Radiation Switch

947K0058A Moscow ELEKTROSVYAZ in Russian No. 10, Oct 93 (manuscript received 11 Jan 93) pp 24-25

[Article by O.K. Sklyarov; UDC 681.7.068]

[Abstract] A new two-position optical lightguide switch has been developed. The new switch is smaller and faster than conventional optical switches based on electro-optical and electro-acoustic effects. Specifically, the switch has a relatively high speed, high beam deflection (on the order of 30°), and low (no more than 0.1 W) control signal power. It consists of a lightguide that serves as a common channel, has the customary core and sheath, and is positioned coaxially with a second lightguide. The plane of the exit end of the first lightguide is sloped to its axis at at angle of  $(\psi-\pi)/2-\varphi$ , and the plane of the entry end of the second lightguide is normal to its axis. Alongside the second lightguide is a third lightguide

whose axis is sloped to the axis of the first two lightguides at some angle a. As is the case for the second lightguide, the entry end of the third lightguide is plane and normal to its axis. The exit end of the first lightguide is located some distance from the entry ends of the second and third lightguides and forms an air gap. The lower part of the gap is filled with an immersion fluid whose refractive index  $n_1$ ' is selected to equal the refractive index of the core  $n_1$ . The amount of liquid is such that its surface is below the lightguides' core. The path of radiation entering and leaving the first lightguide is determined by whether or not the fluid in the air gap expands to fill the entire gap, thus blocking access to the entrance end of the second lightguide. The fluid's expansion is in turn dictated by the temperature to which the fluid is heated. The influence of the capillary effect that is inevitable given the dimensions of the lightguides used in fiber-optic communication is eliminated by filling the space under the fluid with air at a positive pressure of 1.5-2 atm. In addition to eliminating any capillary effect, this positive pressure also helps accelerate displacement of the fluid to its initial position after the heating has ceased. Quartz lightguides with a refractive index of 1.48 may be used for all three lightguides, and ordinary anhydrous glycerin with a refractive index of 1.478 may be used as the immersion fluid. The serviceability of the new switch as a common, coaxial, and side channel was confirmed experimentally by using lightguides with a core diameter of 200 µm. It was stressed that the immersion fluid need not be vaporized in order for the switch to be serviceable; heating to temperatures of 50-70°C is sufficient to increase the fluid's initial volume sufficiently so that it will reach the top level. Such temperatures may be reached in only 10-20 ns with a pulse energy of no more than 10 µJ, which is easily accomplished by using widely available semiconductor lasers. Figure 1; references 2 (Russian).

# Statistical Analysis of Adaptive Sections of Wideband Vacuum-Tube Oscillators

947K0058B Moscow ELEKTROSVYAZ in Russian No. 10, Oct 93 (manuscript received 16 Sep 92) pp 25-27

[Article by V.N. Kotlyarov; UDC 621.396.61: 621.375.026]

[Abstract] The criteria for statistical optimization of the power engineering of the adaptive sections of wideband vacuum-tube oscillators not containing automatic load-matching systems were considered. The operating algorithm of the system considered was geared toward maximum output power and electronic efficiency of the terminal section of the transmitter by establishing the optimum excitation voltage in the vacuum tube's control grid and optimal plate supply voltage at which the oscillator's dynamic range is fully utilized. Working measurements of an actual vacuum tube's electrical operating modes served as the starting data. First a generalized mathematical model of the oscillator stage was developed. The optimal resistance of the vacuum-tube oscillator's load was calculated. The third stage of the statistical

analysis consisted of a computer simulation of a vacuumtube oscillator based on a GU-92B tetrode that was connected in a circuit with a common cathode and operated in a class B mode for a randomly mismatched load. The analysis established that the greater the uncertainty of the impedance of the antenna-feed section of the transmitter, the higher the the energy gain obtained by adapting the oscillator's mode to the load mismatch. This design decision was thus recommended for use when designing items such as wideband shortwave and ultrashortwave radio transmitters for mobile equipment with short antennas where frequency irregularity and time instability of input impedance are both very significant. Figures 2; references 4 (Russian).

# 1-968 Dynamic and Stochastic Distributed Feedback in Lasers (Overview)

947K0050A Moscow KVANTOVAYA ELEKTRONIKA in Russian No. 10, Oct 93 (manuscript received 6 Apr 93) pp 941-968

[Article by G. A. Lyakhov, Yu. P. Svirko, N. V. Suyazov, Institute of General Physics, Russian Academy of Sciences, Moscow; UDC 621.373.826]

[Abstract]This article examines theoretical models that calculate the parameters of distributed (nonlocal) feedback optical lasers. The effective Q-factor approach used was asymptotically accurate, which made it possible to reduce the description of distributed feedback laser generation to a simple system of balance equations with concentrated parameters. The features of laser generation with light induced stochastic distributed feedback are examined. Optical bistability and generation of ultrashort pulses are possible, which reduces the threshold. Explicit equations are obtained which are suitable for practical evaluation of parameters in ultrashort pulse generation. An overview of experimental results is presented with analysis of the features and advantages of using distributed feedback lasers as sources of optical ultrashort pulses. Figures 15; references 104: 62 Russian, 42 Western.

#### Noise Conversion and Laser Induction of Three-Dimensional Structures and Instabilities in a Nonlinear Distributed Feedback System

947K0050B Moscow KVANTOVAYA ELEKTRONIKA in Russian No. 10, Oct 93 (manuscript received 12 Jul 93) pp 969-982

[Article by S. M. Arakelyan, Yerevan State University, Vladimir Polytechnical Institute]

[Abstract] This article examines two problems in the propagation of laser radiation in a distributed feedback system: noise conversion and determination of the conditions in which it is possible to take quantum nondisruptive measurements (with Bragg diffraction) and experiment with the induction of hydrodynamic instabilities by light convection (Rayleigh-Benard) in an anisotropic liquid (classic examination). Emphasis is placed on the possibility of observing

these fundamental states in the field of high-coherence stable continuous lasers. This is important in the development of optical computers and biocomputers. References 56: 41 Russian, 15 Western.

# Method of Shift Formulas for Design of Asymmetric Planar Waveguides

947K0056B Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol. 38 No. 10, Oct 93 (manuscript received 5 Mar 93) pp 1828-1834

[Article by V.V. Shevchenko and N. Espinosa-Ortis; UDC 621.372.8]

[Abstract] a third variant of the method of shift formulas for design of asymmetric planar optical waveguides is proposed, two variants of this method having already been described (V.V. Shevchenko; RADIOTEKHNIKA I ELEKTRONIKA, Vol. 31 No. 5, May 86). Unlike the a-method of transverse waves and the k-method of wave numbers, this ka-method yields a complete expansion of a mode field into modes of a reference waveguide. This method is demonstrated on the TE-mode in a waveguide with a nonhomogeneous guiding layer between two different homogeneous outer layers. As the equivalent reference waveguide for comparative evaluation is used one with a homogeneous guiding layer, as is being done in the other two methods. The field function is obtained from the appropriate wave equations by the usual procedure. The resulting equation for the amplitude of the transverse electric field component is then used for both approximate analytical and exact numerical calculation of the key waveguide parameters such as the critical frequencies and the propagation constants, also the spectral parameter. For illustration is considered a waveguide for surface waves with a guiding layer which has a truncated exponential profile of dielectric permittivity. All those key parameters of its modes have been calculated for various values of the exponent q, to confirm the expediency of this method. Approximate (analytical) calculations may as well be made by the α-method, inasmuch as the kα method does not refine the results within the entire  $0 \ge q > \infty$  range of the exponent. Exact (numerical) calculations for surface waveguides as well as for embedded ones should, however, made by the ka method. Figures 4; references 4. @t

# Possibilities of Electron Beam Interacting with Field of Open Quasi-Optical Waveguide Line

947K0056C Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol. 38 No. 10, Oct 93 (manuscript received 17 Feb 93) pp 1894-1899

[Article by N.L. Romashin and B.M. Paramonov; UDC 621.385]

[Abstract] Possible resonance interactions of electron beams and the high-frequency field in open periodic waveguiding electrodynamic structures are examined, quasi-optical such structures being considered for propagation of electromagnetic waves shorter than the period of these structures. One

known possible interaction is that of a relativistic electron beam and only the field of the first harmonic (fundamental component) of such a structure, their interaction being attended by large diffraction losses tolerable only in ultrahigh-power devices. Another known possible interaction is that of an electron beam and space harmonics of the periodic structure generated on the inside surface of the waveguide rings, in which case one can always minimize diffraction losses by optimizing the dimensions of the waveguide segments. A third possible interaction now under investigation is that of a relativistic electron beam and an oversize waveguide with a retarding structure placed on its inside surface. The possibility of electromagnetic radiation being amplified during resonance interaction of a relativistic electron beam and the field of space harmonics in an open waveguide line is demonstrated theoretically, of interest being radiation wavelengths much smaller than the waveguide period. As a specific case is considered a planar quasi-optical waveguide with a large period 2D on one side and structures with a small period d on periodically spaced mirrors. The efficiency of this interaction is calculated analytically in the Fresnel approximation and then compared with that of conventional interaction where the period of the retarding structure is comparable with the radiation wavelength. It is shown that resonance interaction in such a system is possible even under less stringent design constraints on the electrodynamic structure with a small period d, the Fresnel parameter however depending on the interaction mode and can be as large as twice the number of space harmonics of the 2D period. Therefore, achieving significant interaction output in such a system requires special means of minimizing diffraction losses. Figures 1; references 6.

#### Diffraction of an EM Wave in a Metal-Dielectric Cylinder with Thin Resistive Strips in the Dielectric Layer

947K0061A Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No. 12, Dec 93 (manuscript received 18 Mar 92) pp 2120-2127

[Article by A. I. Fedorenko, N. N. Kisel; UDC 621.396.377]

[Abstract] This article presents a solution (using the integrals method) to the two-dimensional problem of the diffraction of an electromagnetic wave on an ideally conducting infinite cylinder partially covered with a dielectric. Inside the cylinder are thin resistive strips of finite conductivity. It is assumed that the contours of the cross section of the cylinder, coating, and strips are of an arbitrary form. The diffraction of an E- and H-polarized electromagnetic wave is considered. The results show a possibly substantial effect of the strips on the scattering characteristics of metaldielectric cylinders in a resonant range. The algorithms described here make it possible to study a structure with varied electrophysical strip parameters along the cross section contour. The electron paramagnetic resonance may be reduced by 10-15 dB without changing the weight and size of metal-dielectric cylinders. Figures 5; references 11: 10 Russian, 1 Western.

# Absorption of EM Radiation in a Stratified Metal-Dielectric Structure

947K0061B Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No. 12, Dec 93 (manuscript received 14 Jul 92) pp 2128-21 37

[Article by A. Ya. Blank, F. K. Kasimov, A. Ya. Sharshanov; UDC 537.874.6: 621.317.794]

[Abstract] This article examines the absorption of infrared radiation in a periodic structure, a thin corrugated metal film on a dielectric substrate. Absorption in this structure increases sharply, reaching unity. The increase in absorption is due to resonant excitation in a system of surface electromagnetic waves. The amount of absorption depends significantly on the ratio of intrinsic and radiative attenuation. The substrate is necessary to reach high absorption values. The substrate parameters and the angle of incid ence of the external wave are determined. The scattering of a plane p-polarized monochromatic wave incident from vacuum at an angle on a metal-dielectric film is studied. Figure 1; references 7: 6 Russian, 1 Western.

# Method of Determining the Complex Propagation Constant of a Surface EM Wave

947K0061C Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No. 12, Dec 93 (manuscript received 16 Oct 92) pp 2138-2140

[Article by S. V. Kovalev, S. M Nesterov, I. A. Skorodumov; UDC 621.372.8]

[Abstract] A method of determining the value of the complex propagation constant for a surface electromagnetic wave is proposed which does not require kno wledge of the electrophysical parameters of the studied material. The material studied in this article is a rectangular plane- parallel plate with a length of no less than two wavelengths and a width smaller than a wavelength. The material is placed in a UHF field and rotated in the horizontal plane around its minor axis. The signal scattered by the material (in the form of the reflected beam pattern) is recorded. Irradiation of the material with an electromagnetic wave along its long side generates a surface wave that creates maximum reflection in near longitudinal directions. In the reflected beam pattern a distinctive main lobe of the surface wave appears which can be used to calculate the complex propagation constant for the material. The lobe is near parabolic, which is sufficient to determine effective scattering area values. It is much simpler to determine the complex propagation constant using this method. Figures 3; references 3: 2 Russian, 1 Western.

#### Method of Monitoring the Linearity of Opto-electronic Channels Using Photon Count Statistics

947K0061ADMoscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No. 12, Dec 93 (manuscript received 18 Dec 92) pp 2148-2151

[Article by V. M. Ginzburg, N. G. Keratishvili, Ye. L. Korzhenevich, V. I. Sapritskiy; UDC 621.383.3]

[Abstract] This article describes a method of monitoring the linearity of opto-electronic channels used in superweak electromagnetic field reception systems operating in photon count mode. The method is based on control sources of radiation with known (Poisson) photon statistics and comparison with the photon count statistics at the channel output. This method was used in absolute measurement of the quantum efficiency of photoreceptors using spontaneous parametric scattering. The advantage of this method is the simplicity of the equipment. A simple comparison method is visual comparison of histograms. An algorithm is developed to improve upon the comparison. This method is suitable for the measurement of the limits of linearity of opto-electronic channels and operational monitoring. Figures 2; references 4 (Russian).

# Doppler Backscatter Spectrum of the Sea Surface at 20 GHz

947K0061F Moscow RADIOTEKHNIKA 1 ELEKTRONIKA in Russian No. 12, Dec 93 (manuscript received 18 Nov 92) pp 2190-2193

[Article by L. A. Slavutskiy; UDC 5 51.466:621.396.96]

[Abstract] Electromagnetic waves in the centimeter range are scattered from the sea surface on small ripples under conditions of Bragg resonance. In a two-scale model, large-scale waves lead to spatial and temporal modulation of the amplitude of the radar signal due to a change in the local scattering angle, and to phase modulation associated with the orbital velocities of surface elements. This article describes a method of studying the Doppler spectrum of a radar signal with a frequency up to 20 GHz scattered by the sea surface. It is possible to obtain information on the fine structure of the Doppler spectrum associated with resonant scattering on gravitational-capillary ripples in digital processing of the received signal. It is also possible to evaluate the effect of large waves with a period of several seconds. A numerical fast Fourier transform algorithm was used to obtain the radar signal spectrum. The stable fine structure of the spectrum is provided by "sliding" averaging. Digital data processing may be done in real time, so the method is suitable for comprehensive studies of sur face phenomena. Figures 2; references 9: 6 Russian, 3 Western.

#### Slot Antenna on a Cone and Pyramid

947K0061E Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No. 12, Dec 93 (manuscript received 19 Oct 92) pp 2168-2173

[Article by B. M. Levin; UDC 621.396.67.01]

[Abstract] An expression is derived which links the input resistance of a symmetric two-sided slot antenna on a circular infinitely long metal cone and the excited vertex with the input resistance of a metal vibrator whose shape and dimensions coincide with those of the slot. The input resistance of the slot and metal vibrators on a cone and pyramid are calculated with a method based on calculation of the wave resistance of a homogeneous line of infinite length. A radiator placed along the edges of a pyramid is easier to implement than a conical radiator in the shortwave range or at lower frequencies. The conical and pyramidal radiators examined here have a constant and purely active input resistance, which provides a high matching level. If the radiator has finite dimensions, the range of frequencies is limited, but still rather wide. Figures 4; references 7: 6 Russian, 1 Western.

#### Passive Fiber Optic Accelerometer

947K0061G Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No. 12, Dec 93 (manuscript received 27 Feb 93) pp 2228-2232

[Article by A. V. Listvin, V. N. Listvin, V. T. Potapov, S. V. Tverdov; UDC 535.8:666/189.211]

[Abstract] A fiber optic accelerometer based on an angular displacement amplitude sensor is studied. The sensor is based on a multi-mode lightguide. An accelerometer calibration device was developed and its spec ifications are examined. The dependence of the signal to noise ratio on the frequency is shown. At about 30 Hz, the threshold sensitivity to angular displacement is about  $4\times10^{-10}$  rad/Hz<sup>1/2</sup> and to acceleration, about  $10^{-6}$  g/Hz<sup>1/2</sup>. The design and design improvements are outlined. Figures 4; references 5: 4 Russian, 1 Western.

#### Physical Properties of Low-Dimensional Systems, Quasi-One-Dimensional Conductors and Langmuir-Blodgett Films

947K0061H Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No. 12, Dec 93 (manuscript received 2 Jun 93) pp 2249-2277

[Article by S. N. Ivanov, L. A. Galchenkov, F. Ya. Nad; UDC 538.915]

[Abstract] The fundamental physical properties of two low-dimensional structures are studied: quasione-dimensional conductors and Langmuir-Blodgett films. These are new materials that are promising for use in nanoelectronics and molecular electronic s. A new

condensed state is formed in quasi-one-dimensional conductors: a charge density wave. The energy spectrum of one-p article and collective excitations in this state are determined. The properties of the mechanisms of electric conductivity and dielectric permittivity of quasione-dimensional conductors are studied in a wide range of temperatures and electric fields. Conducting Langmuir-Blodgett films are manufactured and studied. The films are made of a mixture of amphophilous donor and acceptor molecules. The optimal composition of the mixture is determined from the point of view of conductivity and film stru cture. The conductivity activation energy is found, as well as the Hall mobility and type of current carrier. A sharp reversible change in film resistance is observed during heating, which is caused by reversible changes in the structure. Mechanisms of film conductivity are discussed on the basis of the results. Figures 23; table 1; references 68: 16 Russian, 52 Western.

## Electron Gun of a High-Current Accelerator with a Tubular Beam

947K0060A Moscow PRIBORY I TEKIINIKA EKSPERIMENTA in Russian No. 6, Nov 93-Dec 93 (manuscript received 30 Mar 93; after revision 8 Jun 93) pp 132-136

[Article by A. N. Bastrikov, S. P. Bugayev, A N. Zakharov, V. I. Koshelev, V. V. Lopatin, K. N. Sukhushin, P. A. Khryapov, Institute of High-Current Electronics, Siberian Division, Russian Academy of Sciences, Tomsk; UDC 621.384.6]

[Abstract] A new electron beam for experiments on the generation of high-power UHF radiation is described. Experiments are conducted to form tubular electron beams in a coaxial diode with magnetic insulation. Beams are obtained with a diameter of 340-360 mm with diode voltage of 0.85-2 MV and a pulse length of 0.6-1 µs. The power of the electron beam reaches 100 GW in the drift tube. Figures 3; references 6 (Russian).

# Generation of Strong EM Pulses with a Subnanosecond Front

947K0060B Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No. 6, Nov 93-Dec 93 (manuscript received 30 Sep 92; after revision 1 Mar 93) pp 125-128

[Article by S. V. Albetkov, K. Yu. Sakharov, A. A. Sokolov, V. A. Turkin, All-Union Scientific Research Institute of Opticophysical Measurements, Moscow; UDC 621.372.833+621.373.2:621.372.2]

[Abstract] The main problem in building powerful electromagnetic pulse generators is the construction of the wideband transition from the coaxial generator channel, which is filled with an electric insulation medium, to an asymmetric bandline with air insulation. The transition between the symmetric and asymmetric sections has the

minimum possible cross section while retaining electric stability. This insures minimal distortion of the leading edge of the pulse between the symmetric and asymmetric portions. The wave channel of the generator was studied using pulse reflectometry. Local distortions were found to be no greater than 15%. The band line has an amplitude of up to 500 kV/m (1.3 kA/m) and a edge length of no greater than 0.5 ns. As a comparison,the Swiss GTEM 1500 installation forms pulses with a edge length of 1.5 ns and an amplitude of 24 kV/m (24/377 kA/m). Figures 3; references 8: 7 Russian, 1 Western.

# Cycle Synchronizer for Digital Magnetic Recording Systems

947K0060C Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No. 6, Nov 93-Dec 93 (manuscript received 9 Feb 93; after revision 5 May 93) pp 101-106

[Article by A. V. Akselrod, A. A. Kozyrenko, Institute of Applied Astronomy, Russian Academy of Sciences, St. Petersburg; UDC 621.397.611.037.372]

[Abstract] A device to isolate syncrhonizing sequences at 5 MHz from a playback signal in an RT-1 VHS recorder (recording speed 5 megabits/second using a self-synchronizing Miller code) has been developed at the Institute of Applied Astronomy for ultralong baseline radio interferometry. The device operates on the principle of digital phase automatic frequency adjustment. Digital operation is easily implemented even at rather high frequencies. Tuning is reliable and easy. The space-saving design may be used in the construction of multichannel systems. Figures 3; references 3 (Russian).

# Russian Microelectronics Industry Struggles for Survival

947K0054AMoscow DELOVOY MIR in Russian 10-16 Jan 94 p 11

[Interview with Pavel Prikhodko, deputy science director of Zelenograd Scientific Research Institute of Molecular Electronics and the "Mikron" Plant, Anatoliy Skvirya, director of "Silikon" Scientific Production Enterprise, and Aleksandr Sokolov, vice president of "Sikikon" by Nataliya Lazareva, DELOVOY MIR correspondent; place and date not given: "Microelectronics—A Spark of Hope"]

[Text] Many people are now concerned about the situation at industrial micro-electronics enterprises, among other places at plants and scientific research institutes of Zelenograd (Russia's "Silicon Valley"). It is here that a host of problems have arisen associated with defense conversion, high-tech advances, development of a market for information-related products, and of course, these problems are becoming especially acute in connection with the privatization of these businesses. It seems that enterprises of this kind are tottering on the edge of extinction due to the

comparatively intense influx of Western information technology into Russia and bordering nations, which is quite natural, given that we are so dreadfully far behind in this area. Bankruptcy, outside leasing, or sale of premises and hands to foreign companies—is this the end?

Our correspondent Nataliya Lazareva talks with the deputy science director of Zelenograd Scientific Research Institute of Molecular Electronics and the "Mikron" Plant, Pavel Prikhodko. Also taking part in the discussion were representatives of the small scientific production enterprise "Silikon": its director Anatoliy Skvirya and vice president Aleksandr Sokolov.

IPrikhodkol Heretofore, most of the output of our enterprise was produced for the defense industry. Today this is no longer a secret. Nor is it a secret that our economic situation and development has been stable and secure: state orders, government support, priority funding. We have developed in conformity with long-term ideas and plans. In the period of 1984-1985, in my opinion, we were minimally behind the world level of the electronics industry, probably only about 3-4 years. We were being used by as many as 18 Soviet ministries: ultrapure materials, electronic equipment and precision machine tools, nonferrous metals, chemistry. Everything was clear and comprehensible for people, and salary was guaranteed. Moreover, the standard of living in Zelenograd was much better than that in other regions of the country. We could pick the best college graduates for our plants and institutes, engineers and workers were in competition for jobs.

[Lazareva] And was everything really so tranquil?

In reality, not at all. The main creeping danger was that people who had a comparatively high wage for those times were making no effort to improve quality and increase productivity of their labor.

[Lazareva] Indeed, that was no small danger for this kind of production. And when did the situation change drastically?

[Prikhodko] Our main troubles started in 1991. There was a dramatic reduction of state orders and budget funding, the Soviet-wide division of labor disappeared, and we were left without suppliers. Figuratively speaking, we were in a potential well. The simplest thing to do in such a situation is to let the buildings be used for commercial warehouses, and start making knickknacks, but that is not what was done. It ought to be mentioned that a microelectronics enterprise can't be shut down, something like an openhearth furnace: purification of water and air, preparation of energy carriers, everything has to operate continuously. Besides, we knew that if people were laid off for very long without pay, we would not get them back. Therefore, simultaneously with curtailment of our usual production, we began to retool and set our sights on conquering our sectors on the international market.

[Lazareva] That was tough for sure; there wouldn't be many outside our country who could believe that we were in any condition to compete on the world level in microelectronics.

[Prikhodko] That's right. We were hard put to find foreign partners. A lot of times we took part in several delegations in a day. At first we were unable to make contacts; at that time we didn't have a handle on the way things were done. But it was explained to us by a representative of a Japanese company that according to their lights it is considered normal to make a little headway in one out of 200 talks. We had our first success with representatives of the Samsung Company. We agreed to produce on franchise a small clock chip for sale on their market. This is where the switch began from the Soviet to the Western style of production. We were well aware that this switch would take enormous capital investments: a different production structure would have to be set up. And incidentally, it cannot be said that this would have been beyond our reach. The level of production and quality control at our plants was still the highest in the nation: items went directly to outfit special facilities and space vehicles. In 1991, we experienced some decline in facilities for production development. In 1992, they began to arrive, and were mainly put to use in elevating the technical level of production. Samsung was followed by agreements with companies in Hong Kong, Taiwan, and some European companies. Now more than 40% of the volume of our production output is exported by agreements. For businesses like ours, there has been a sharp decline in the number of previously planned state defense orders. We need a lot of money to acquire new equipment operating on the level of the latest technologies. Construction has now started on two new shops for producing LSI chips with micron design standards. A conglomerate of state structures is investing money in construction of one of these, and the "Korona" Joint Enterprise that operates in contact with a Hong Kong company is investing in construction of the other shop.

#### [Lazareva] And what have been the results?

[Prikhodko] The Russian production line is now in its third year of construction. The production cycle is totally dependent on the dynamics of incoming budgetary finances. "Korona" has promised to complete construction in 20 months. Right now, 49 percent of the investment in this enterprise is foreign, and 51 percent is ours. We, of course, will have the controlling block of shares.

[Lazareva] But you can see that this is not a very productive way. The production manager is engaged in lots of talks, looking for partners... the next thing to hustling.

[Skvirya] We realized long ago that a new approach is needed here. And we are best suited for it: a small mobile enterprise where scientists work together who have a lot of contacts in their fields throughout the world. We know the directions of promising research, the interests of partners, and a host of foreign companies where talks

will lead to the desired outcome. Many Western specialists and managers prefer to deal first with a small non-governmental company. So it is just this scientifictechnical "pimping" that we are taking as one of the areas of our operations. It is convenient, effective, and mobile. On the other hand, we are the very ones who are concerned about Zelenograd enterprises. After all, they are like our children. "Silikon" originated at one time in the bowels of the Moscow Institute of Electronic Technology. Graduates of that institute are now working in the research institutes and plants of Zelenograd. Even Pavel Prikhodko and the director of "Mikron," Gennadiy Krasnikov, are former MIET students. So our specialists are well aware of the industry in Zelenograd, its needs and specifics.

[Lazareva] And who else is "Mikron" involved with?

[Prikhodko] The mainland Chinese are very much interested in our technical advances. They are now marshalling considerable efforts and state funds for development in microelectronics; but Western franchises are too expensive, and therefore they are giving a lot of attention to markets of Russian microelectronic technologies. Contacts with the People's Republic of China may be quite profitable. I have been in China, and have had a lot of talks with their managers. Although it is well known that they are the oldest traders in the world, many of them are seriously studying marketing in Japan. Talks with representatives of Chinese companies always necessitate carefully reasoned strategy and tactics, bordering on art. Within the scope of this cooperation, we are also hoping to penetrate into the remaining markets of China and other Southeast Asian nations. You know, to all appearances, Western European nations are in no hurry to deal with us. And the situation with the U.S. is even more ambiguous. It looks like things are getting easier with regard to KOKOM organizations, but in connection with defense conversion—and they are involved in that, too-there are now already about 65,000 unemployed in their "Silicon Valley". So it is unlikely that there would be any profit from selling them franchises to the Russian market.

[Sokolov] According to some information, recently "Silicon Valley" companies that have been trying to establish relations with Russian businesses are having a tough time, and even being fined. But on the other hand, they won't be able to get by without contacts with Russia. The microelectronics industry is really quite hazardous. The U.S. is desperate to get it out of their country. Up until now, they have got by on contacts with Southeast Asian nations. And they are extending these contacts to us, as well—labor is cheap here, too. We would rise up against ecologically unsafe production, but that would put an end to our hopes for the future. Russia has to go through the stage of production by franchises, working to some extent for the Wes' rn market. In doing so, we must not fail to give some thought to the ones with whom we make contact. It would not be in our best interests to acquire technologies that are outdated (for them), going nowhere from the engineering standpoint, and ecologically dirty;

and so far, that is what we are being offered. We have to look for the most promising franchises: comparatively new, competitive, and with opportunities for further independent development. This is the direction that our company is trying to take.

[Lazareva] But by your own words, the implication is that this is scarcely possible under present conditions.

[Sokolov] The main thing is to understand with whom we can deal. For example, we have been well aware that specialists of the well known U.S. company "Sun Microsystems" are working with Russian scientists, with the Moscow center of SPARC technologies, and with the largest Russian developer of supercomputers, Associate Member of the Russian Academy of Sciences Boris Babayan. We have understood that these are the contacts that are needed. We have not procrastinated in starting talks, and have achieved some promising results. "Sun" has offered a franchise to "Mikron" for producing microprocessors by the most progressive SPARC technology.

[Lazareva] SPARC is a homonym of "spark". So is the franchise from "Sun" a spark of hope?

[Sokolov] To some extent, yes. The fact is that "Sun" takes pride in its open technical policy. And that policy includes the opportunity, if that is the right word, of further creative development of their circuits. We have purchased not just a technology, but also data about the theoretical principles of production of the chip, mathematical groundwork, and architecture. On this basis, we have acquired access to international standards. And thanks to the considerable experience of scientists in our nation, we will be able to use the acquired technology as a springboard, or to put it in a better way, to skip over several steps and create our own Russian devices that are modifications of U.S. chips meeting specifications on the world level. There are companies in Russia that are ready to use these chips. It has been suggested that we use them for Russian workstations based on powerful personal computers. Design problems are being studied by Vladimir Betelin, director of NIISI [not further identified) of the Russian Academy of Sciences. In future he is hoping to arrange for industrial production. To carry out this project, monetary credits are being requested through the line of the Russian Academy of Sciences. The same source will allocate the necessary funds for "Mikron" to acquire a franchise for the chip.

[Lazareva] But are you sure that you will be able to carry out such ambitious plans just now?

[Prikhodko] Thanks to maintaining our potential for this period, we have not yet run out of energy. We are now starting to carry out large-scale international programs. The first is tied up with the "Sun" franchise. The second novel technology that we have developed is ultrathin silicon films on an insulator. This is called the SIMON process. A Russian- U.S. joint enterprise has already been set up. The money is being contributed by the U.S. side and some Russian businesses and organizations. Billions of rubles are needed for this promising technology. Our minister of science Boris Saltykov is very interested in this project. His technological fund is now ready to invest the necessary money in the SIMON process. To have the capability of carrying out the most flexible technical and economic policy, as well as to establish the closest working contacts with the world microelectronics community, our plant and his research institute have now set up a joint-stock company of open type. We feel that this is the most convenient form of privatizing a large state enterprise.

[Lazareva] Well, have you lost any of your essential personnel?

[Prikhodko] Of course, small businesses have taken away a lot of my specialists, and incidentally the best of them. One expects this. It is the educated, inventive, linguistically talented people with a feel for technology who can confidently count on independent success in small business. And many have been successful, but unfortunately are losing the qualifications necessary for our work. Right now in our association the average pay scale is 62,000. And the salary reaches something like 120 in a bread-baking plant, and even more in some small enterprises. Naturally, some are leaving for commercial structures, especially banks. We are also aware that the most successful of those who have left us for free enterprise are trying to get the greatest number of our shares when they are auctioned off. It is natural that in this situation we look out for the interests of our team of scientists and workers, so that they will be able to make continued use of the potential in microelectronics that they have created.

Let us hope that the controlling block of shares will go to people with clarity of purpose who have staked a lot and know what is worth attaining by their investment. And in the given case, the only thing worth attaining is getting the Russian microelectronics industry properly into the world distribution of labor, and making a profit. Analytic Relationships for Calculating Capacity of Multiple Access Satellite Communication System

947K0059A Moscow TEKHNICHESKAYA KIBERNETIKA in Russian No. 6, Nov 93 Dec 93 pp 90- 97

[Article by A.A. Nazarov, M.P. Nevolko S.B. Pichugin (Moscow)]

[Abstract] A specialized subscriber access algorithm and analytic relationships for calculating the capacity of a satellite communication system (SCS) is proposed. Two configurations of an SCS that implements the algorithm are examined. The first configuration assumes the simplest message stream generated by

subscriber stations; the holding time is a random variable with an arbitrary distribution function. In the second configuration the message stream consists of simplest streams with different intensities and a certain holding time distribution. Both configurations are loss type queuing systems. Analytic relationships for calculating the capacity of this SCS are determined using the theory of queuing systems, particularly, the body of Markovian line processes. It is concluded that, all other things being equal, in order to determine an SCS capacity it is sufficient to know the average length of subscriber conflict notification and not to use the distribution law. An SCS capacity is higher when message switching is used. Figures 2, references 3.

#### **NUCLEAR AND NON-NUCLEAR ENERGY**

#### We Need Nuclear Power Plants

947F0060A Moscow SEGODNYA in Russian No. 17, Feb 1994 p 9

[Article by Vladimir Kuznetsov]

## It is Just as Important That We Know How to Decommission Them

[Text] "Do not shut down any more reactors for any reason!" pleaded Victor Mikhaylov, head of the Russian Federation's Ministry of Atomic Energy, during an interview published in KOMSOMOLSKAYA PRAVDA. He is, of course, aware that six reactors already stand idle on the territory of the former Soviet Union, including:

- reactor 1 at the Metsamor nuclear power plant, idle since February 25, 1989, and reactor 2, idle since March 18, 1989;
- reactor 1 at the Novovoronezh nuclear power plant, idle since August 6, 1984, and reactor 2, idle since August 29, 1990;
- reactors 1 and 2 at the Beloyarsk nuclear power plant, idle since September 10, 1981, and September 10, 1989, respectively.
- Sixteen other reactor systems, including research reactors as well as critical and subcritical test reactors, are also being shut down.

The development of nuclear energy worldwide is closely regulated by the domestic nuclear policies of individual nations and by international law. Russia, however, although it regulates the design, start-up, and operation of its nuclear power plants, has no guidelines for decommissioning them. In a number of cases, this means delays in proceeding with the dismantling of plants that are currently in safe storage.

Meanwhile, since 1979, the Commission of the European Community has been assisting the international community in coordinating its efforts to resolve problems associated with decommissioning nuclear power plants. The commission establishes and finances from its general fund five-year research programs geared towards safety issues and protection from radiation during nuclear facility decommissioning.

Between 1979 and 1993, the CEC sponsored three programs for a total of 93.8 million European currency units (in December 1993, 1 ECU equaled 1.11 dollars), and 126 program-related contracts were drawn up.

Programs administered by the International Atomic Energy Agency have established data bases on handling radioactive wastes and safely transporting radioactive materials.

In Japan, the RAN-DEC (Research Association for Nuclear Facility Decommissioning) was founded to study ways to safely dismantle obsolete nuclear facilities.

In 1979, the Technical Information Center was established at the US Department of Energy's Oak Ridge National Laboratory to provide information on the dismantling and decontamination of nuclear facilities.

And what is happening with the four idle reactors we now have in Russia? At the Novovoronezh nuclear power plant, work is being done to complete the radiation survey of the equipment and structures (the work is about 70% complete), to develop experimental technologies for reprocessing radioactive wastes, and to decontaminate and dismantle the equipment. Spent nuclear fuel is completely removed and stored on site due to problems associated with transporting the containers and with the Mayak production association's (Chelyabinsk-65) refusal to take delivery of the fuel.

The first and second reactors of the Beloyarsk nuclear power plant, which are uranium-graphite RBMK-type reactors, were shut down because their critical components had reached the end of their rated service life and no longer complied with modern safety standards, and because they are not slated for reconditioning.

Beloyarsk-1 was shut down clear back in 1981. All of the fuel assemblies have been completely removed from the reactor. No more than 180 kg of fuel (measured with the gamma method, or 130 kg if the neutron method is used) remains in the form of "spillage" scattered throughout the reactor's pressure vessel lining. The reactor power control, active ventilation, and energy conservation systems are still running.

Beloyarsk-2 was shut down in September 1989. Removal of the spent fuel assemblies is nearing completion. Emissions of radionuclides into the unit's ventilation system are lower than levels detectable by the original monitoring equipment.

The plant's spent-fuel pools hold 4990 spent fuel assemblies in casks designed for "dry" storage. Because the seals of some of the containers have lost their integrity, uranium sometimes comes in direct contact with the cooling water, the radioactivity of which has increased 1.6-fold over the last three years. Technical safety requirements for storing spent fuel and handling radioactive wastes are not being observed.

Unfortunately, Russia's Ministry of Atomic Energy has pretty much left reactor decommissioning up to local authorities, resulting in missed objectives and unfinished work. Moreover, inspections by federal agencies have turned up violations of nuclear power safety practices and procedures, and, as a result, further decommissioning work has been suspended at the Beloyarsk nuclear plant until safe and proper working conditions are restored.

Beginning sometime between the years 2000 and 2005, most of the reactors at Russia's nuclear power plants will begin decommissioning, to wit: reactors 1 and 2 at the Kola nuclear power plant; reactors 3 and 4 at Novovoronezh; reactors 1-4 at Bilibino; and reactors 1 and 2 at

Leningrad. Regardless of the reasons for decommissioning, it is an inevitable stage in the service life of a nuclear power plant. Therefore, it is necessary to formulate a comprehensive policy for decommissioning nuclear power plants, and this can only be accomplished with a great deal of theoretical and experimental information. The current inability to understand this or move this work forward will only cause additional problems for future generations.

# Oil- and Gas-Bearing Systems of Subsalt Deposits of Eastern Margin of Pre-Caspian Depression

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Article by I. B. Dalyan and Z. Ye. Bulekbayev, PGO Aktyubneftegazgeologiya UDC 681.036

[Abstract] The subsalt sedimentary mantle of the eastern margin of the Pre-Caspian Depression, down to a depth of 6,935 m, in a stratigraphic structure ranging from the Lower Permian Artinskian Stage to the Lower Devonian, contains four identified lithologic-stratigraphic oil- and gas-bearing systems belonging, based on lithologic-facies features, to various formations with different geochemical sedimentation conditions, scattered organic matter content and degree of catagenesis, having generating argillaceous deposits and oil and gas horizons with various types of traps. Their ages and differentiation are based on micropaleontological and palinologic factors. Detailed descriptions of the various formations are given along with site locations and breakdowns of the oils, condensates and gases noted. Seismic surveying and core sampling are used. The subsalt system contains hydrocarbon accumulations and pools and has mantles of argillaceous deposits and dense aphanitic carbonates. The Lower Permian sand-and-clay deposit systems forms an enormous clinoform containing claystones with small interlayers of brownish-gray limestones, siltstones, sandstones and gritstones. The sandstone-siltstone deposits decrease in thickness from east to west and the gritstones, in the same direction, are being replaced by sandy varieties. The system's upper boundary runs along the bottom of a Lower Kungurian Substage anhydrite seam, a logging marker for the depression's eastern margin, and the lower runs along the roof of carbonates in the Zhanazholian tectonic stage and a gammaemitting band of black terrigenous-siliceouscarbonaceous rocks in the rest of the eastern margin. Part of the Lower Permian deposit system overlies Gzhelian CL-I [Carbonate Layer I] rocks, some of which show facies replacement by same-age deep-sea sediments of the gamma-emitting band. The Lower Permian system covers the first gamma-emitting band, which is spread above the CL-II carbonates, which show facies replacement by deep-sea sediments further west, toward the depression's central part. A second gamma-emitting band below the first joins with it and covers Lower Carboniferous Tula Horizon terrigenous deposits. Lower Permian Sakmarian and Asselian deposits in the northern extension of the North Embian uplift are carbonates overlying the CL-I layer and covered by Middle Jurassic terrigenous deposits. The Lower Permian deposits, located between reflecting marker horizons, decrease in thickness from east to west and from south to north, with complete or partial erosion noted at a number of sites of the nearside zone of the Ostansuk depression, the result of uplifting of the eastern margin area which forms the Ural Folding System. The Lower Permian system gradually sinks from east to west, from 2.3 km at the Ashchisay Fracture confining the eastern part of the Pre-Caspian Depression to 5.6 km at the Shubarkuduk tectonic stage. A diagram is given of various structural elements of the eastern margin, showing various eastern margin boundary factures, sites, deposits and uplifts with signs of oil and gas in subsalt deposits, identified and assumed sections lacking Lower Carboniferous terrigenous deposits and various tectonic stages. The isoclinal Ostansuk platform depression is in the northeastern section of the margin. The Lower Permian rock system is an oil source bed with a high concentration of organic matter, basically sapropelic with some humus, and the deposits also contain various bitumens (some traces of epigenic type) and iron components (ferrous, pyritic and ferric). Hydrocarbons in the system have migrated to traps. Reference horizons (sandstones and siltstones) 12-135 m thick contain oil-bearing horizons, three Artinskian, four Sakmarian and one Asselian. The oil-bearing layers have various filtration properties and flow rates. Lower Permian deposit oil pools are dome types, but erosion shearing may have resulted in stratigraphic oil pools shielded by Kungurian deposits. The system's oils are brown and dark brown, with traces of sulfur, paraffin, sulfate resins, silica gel and asphalts. The methane-naphthene oils' hydrocarbon composition consists mostly of carbon, hydrogen and oxygen with traces of sulfur and nitrogen. The Gzhelian-Late Visean carbonate rock system, widespread in the depression's eastern section, consists of two layers, separated by Lower Podolskian Horizon sand-and-clay deposits and located between reflecting layers, and they were formed under shallow sea-basin shelf conditions and subjected to erosion when they were above sea level. Various limestones (organogenic-clastic, polydetrital, clusteredlumpy and pelitomorphic) are present, with a few dolomites. Various permeable seam traps exist. The lower layer's carbonates show sulfate formation and tufagenous material is present (feldspar crystals and some quartz). The system's upper boundary runs along a roof of Gzhelian limestones and anhydrites and the lower along a floor of Upper Visean limestones which lie on top of Middle Visean Tula Horizon terrigenous rocks. The Gzhelian-Late Podolskian upper carbonate layer (CL-I), located between seismically reflecting layers, containing mostly carbonates, with anhydrites in the northeast and terrigenous deposits in the north, has four productive gas and oil pools 20-50 m thick. Upper Carboniferous upper gas and oil pools have the best trap properties. Oils are mostly methane-naphthene types, with sulfur, paraffin, resins and some asphalt, basically composed of carbon and hydrogen with slight amounts

of oxygen and nitrogen. Condensates are bright-yellow methane-naphthene types, sulfurous, low-paraffin and resinous. Gases are primarily methane, ethane and propane with lesser amounts of butane, pentane, hexane, nitorgen, carbon dioxide and hydrogen sulfide. Kashirian-Late Visean lower carbonate layer CL-II lies at depths ranging from 1,930 m to 5,280 m between reflecting layers and is divided by nine lithologicstratigraphic horizons, with trap seams up to 70 m thick containing productive oil and gas pools and the seams separated by impermeable carbonates. Oils are greenishbrown methane-naphthene types, basically sulfurous, low-paraffin and slightly resinous with asphalts and composed of mostly carbon, hydrogen and oxygen, with a small amount of nitrogen. Condensates are brightyellow and yellow methane-naphthene types, with small amounts of sulfur, paraffin and resins (up to 20 parts per 1000). Hydrocarbon gases are mostly methane and ethane with lesser amounts of propane, butane, pentane, nitrogen, carbon dioxide and hydrogen sulfide. CL-I and -II carbonate system oils are basically the same type with differences in physical and chemical properties and an increased sulfur content associated with secondary changes during vertical migration of the oil and the influence of carbonate rocks on the migration paths and in the pools. Sedimentation of CL-I and -II occurred under unfavorable conditions of a shallow coastal sea basin shelf under oxydizing and dynamic circumstances. The carbonate rock system is not an oil source and could not produce hydrocarbons, the pools of which formed by migration from a Lower Permian oil-source system and possibly partially from deeper Lower Carboniferous terrigenous rocks. CL-I and -II carbonates contain epigenetic asphalt from two production periods, the second an oil-type, bright yellow with a bluish tint, found in porous layers, fractures and caverns. Gas pools formed apparently due to a sharp pressure drop during the oil's migration from lower terrigenous deposits to the highersituated carbonates. Gamma-emitting bands of terrigenous-siliceous-carbonate rocks, widely dispersed in the eastern part of the Pre-Caspian Depression, are deep-sea or relatively deep-sea age analogs of Carboniferous carbonate deposits, are located under Asselian deposits and are reference horizons with bituminous organic matter, a significant amount of which is sapropelic in nature and gives them a chestnut-brown color. Rocks of the first gamma-emitting band, 18-83 m thick, are analogs of the deep-sea facies replacement of CL-I carbonates and are above the CL-II carbonates. Deposits of the second gamma-emitting band, 78-102 m thick, are analogs of CL-II carbonates, are on top of Middle Visean Tula Horizon sand-and-clay deposits and include claystones, limestones, radiolarites, silicites and siltstones with tuff and volcanic ash. The first band (at the 5050-5102 m level) has redeposited Upper Carboniferous and Moscovian foraminifera and the second (at the 5102-5177 m level) has redeposited Middle and Lower Carboniferous foraminifera. The claystones are silicified and pyritized, black, strongly bituminous, oily to the touch, with siltstone interlayers and occasionally turn into radiolarites

and silicites. The limestones are silicified, black, aphanitic, dense, oily to the touch, with calcite-filled fractures and interlayers of silicites. The radiolarites are silicified. occasionally pyritized, slightly argillaceous, dark chestnut-brown and gray, platy, thin-layered, dense and bituminous, with some replacement by chalcedony and opal. The gamma-emitting bands are highly bituminous, with sapropelic organic material at the mesocatagenesis substage, and can be listed among the oil-producing deposits. Oils are brownish-green, low-sulfur, slightly resinous, with paraffin and some asphalt, and basically methane-naphthene types. The Lower Carboniferous sand-and-clay rock system of the Tula Horizon-Tournaisian graywacke formation extends in the eastern margin to the south of the Shengelshiyskiy sublatitudinal fracture. Present are claystones, siltstones and sandstones with interlayers of conglomerates similar in color and composition to the silico-igneous formation of the Sakmarian zone of the Mugodzhary mountains. Deposit thickness is 448 m at Vostochnyy Akzhar, increases to the east, reaching 1,510 m at Zhanaton, and also increases to the west according to seismic surveying. Greatest deposit thickness of up to 4.5 km occurs in the Embian pericraton deflection. The Middle Visean-Tournaisian rock system surface is a reflecting layer with the lower boundary running along a base of terrigenous rocks on top of Upper Devonian carbonates. Middle Visean-Tournaisian argillaceous deposits have a high organic-matter concentration, sapropelic-humus type, accumulated under favorable coastal-sea geochemical conditions, are oil-producing types and liquid hydrocarbon production is evident in the eastern margin, especially intensively in the Embian deflection. Structures formed in this region by the time hydrocarbon production began should be viewed as zones of oil and gas accumulation of sygenetic pools and primary sites for oil and gas prospecting operations. Lower Carboniferous deposits, from which oil has been obtained, need more study. The oil and condensates are predicted to be low-sulfur types based on genetic features of scattered organic material in Lower Carboniferous sand-and-clay deposits. The Middle Visean-Tournaisian deposits' oils are syngenetic to the surrounding rock, brownish-green, low-sulfur, with paraffin and some asphalt, and basically methane-naphthene types. A table is presented, showing the depths of the occurrences, in meters, of oil- and gas-bearing systems of subsalt sedimentary mantle deposits at various sites, ranging from Lower Permian down to Prelower Devonian and including the gammaemitting bands, the CL-I and -II carbonate layers, the Lower Carboniferous gamma-emitting claystones and the Devonian carbonates. Upper Devonian carbonate system is between one set of reflecting horizons and Middle and Lower Devonian systems are between another set and are basically limestones with interlayers of claystones and organic matter and oil ooze in the fractures. Prelower Devonian deposits are darkgreen-to-black dioritic porphyrites with calcite-filled fractures. Most of the rocks are plagioclase (andesites) with some hornblende, quartz and biotite, secondary minerals such as actinolite, apatite, chlorite and epidote,

and accessory minerals such as magnetite, titanomagnetite and pyrite. The dioritic porphyrites have been subjected to dynamic metamorphism. The subsalt sedimentary mantle has three rock systems with high generating potential, in which hydrocarbon-generating processes have occurred and hydrocarbon traps are present. Lower Carboniferous terrigenous deposits have a greater production potential than Lower Permian. The gammaemitting layers need more study. The depression's eastern section has four regional oil- and gas-bearing subsalt rock systems and shows some promise for discoveries of new hydrocarbon accumulations in the eastern margin. Structural formations arose much earlier than hydrocarbon production and endured some reorganization and disruption of the hydrodynamic conditions as shown by heavy oxydized residual oil in Lower Permian deposits. Deep-seated fractures are believed to be indicative of possible oil and gas fields, should help in future prospecting for oil pools and may also be helpful in locating new pools in CL-I and -II layers. Slopes of bulges and uplift areas which formed covering structures on Lower Carboniferous, Devonian and much older deposits may be promising for prospecting for stratigraphic oil pools. Figures 2.

#### **MISCELLANEOUS**

# New Theory of Structural Damage Caused by Earthquake Effects

947C0224A Moscow NEZAVISIMAYA GAZETA in Russian 1 Mar 94 p 6

[Article by Sergey Smirnov, doctor of technical sciences, Moscow State Architectural University: "A New Seismic Doctrine: the Real Danger During Earthquakes Is Not in the Soil Vibrations, But Rather, in the Compression Shock Waves"]

[Text] According to the current official doctrine, it is believed that buildings are destroyed during earthquakes by their own vibrations, which are caused by ground vibrations which are close to them in frequency. The latter are also recorded by seismic instruments. However, the constant and completely inexplicable failures in the struggle against seismic damage has led to the idea that something here is not as it seems and that the seismic engineers are protecting buildings not from actual danger, but rather, from a false danger. The actual danger, however, has remained unnoticed up till now.

This mistake had not been discovered only because, up till now, the seismic engineers and seismologists have been the only ones concerned with the most complicated problem of seismic damage. At the same time, all the prominent specialists in the theory of the threshold equilibrium, destruction and durability of structures disregarded it. And it never occurred to anyone that the patterns of seismic damage are a unique source of invaluable scientific information about the true nature of the seismic effect on buildings.

When I reproduced a series of standard seismic strength analyses with due consideration of the ground vibrations recorded at the same time, I obtained a paradoxical result. It turned out that, in half of the instances, the buildings should not have been damaged at all, while, in the rest of the instances, the damage should have been completely different. Consequently, the results of the currently used standard seismic strength analyses do not reflect at all the actual pattern of the phenomenon at all.

After analyzing the nature, properties and regularities of all the seismic damage from the standpoint of structural mechanics, I managed to reproduce the mysterious effect which caused it. Up till now, this problem had not been solved. It turned out that the seismic damage represented the precise replication (or impression) of the sought-after effect and it is only necessary to know how to interpret it. As a result, I managed to discover some very interesting facts which had not been known previously and which, however, are of extraordinarily important practical value. All the damage during earthquakes takes the highly unusual form of a "clean shear." This is completely "abnormal" for the behavior of reinforced concrete columns, partitions and lintels from the point of view of structural mechanics. Such damage contradicts the standard properties of the flexible components which should always fracture and not shear. Moreover, this kind of damage differs in its nature from all known types and is not encountered anywhere else. So far, it has not been possible to reproduce it artificially, even by means of underground explosions. In its form, it absolutely does not correspond to and is even at variance with the ground vibrations which have been recorded at the time of its appearance. Consequently, these vibrations cannot cause the actual damage.

It follows completely obviously from all these facts that the main premise in the current seismic "vibrational" doctrine is false. The true damaging effect which corresponds to the pattern of seismic damage may be not the vibrations, but rather, just the compression shock waves which are not recorded by current instruments. It is precisely these waves which give rise to the shear shock waves in the columns and walls of buildings and instantaneously shear them. The columns do not even have time to bend and the buildings do not have time to sway. This automatically means that all the currently used quake-proofing measures and designs are absolutely useless. They protect buildings from ground vibrations but, in principle, they are not capable of protecting them from shear shock waves.

For example, we frequently place buildings on flexible columns, saving them from resonance vibrations, while, as a result of an earthquake, these protective columns simply snap like wooden matches and the buildings collapse without even having had time to shake.

When there are ground vibrations and they cause buildings to vibrate, the columns and partitions should fracture on the ends. But one of the many seismic paradoxes is the fact that such fractures of columns, partitions and lintels do not develop during earthquakes. Instead of them, an oblique shear develops in the columns (most often in the middle), as if they are being cut in two by a giant saber. Inasmuch as there is no fracturing of flexible structural elements during earthquakes, this means that there are no dangerous ground vibrations there. But then, just what kinds of vibrations, in actual fact, are the current seismic instruments showing us? The instruments are not recording actual ground vibrations at all, but only their own vibrations, which have been caused by the shock waves in the ground. Up till now, such an interpretation of the accelerometer recordings, one disagreeable for the seismic engineers, did not occur to anyone.

As soon as the seismologists handed over the information about seismic ground movements to the builders for their use, they immediately also lost the monopoly for the assessment of its accuracy. Their mistake "crossed" into another's field, one not under their control, the field of structural mechanics. And this is one of the most experiment-based and precise sciences. It possesses a unique ability for determining the accuracy of the description of any external effect on a structure (including a seismic one). The strength analyzer gives it this ability, since it establishes the firm connection between the initial effect and the structural damage pattern which corresponds to it. If the damage pattern expected by analysis does not match the actual pattern, this means that the description of the external effect is also invalid. It is precisely this result which occurs in all seismic strength analyses.

So, structural mechanics indisputably establishes the erroneousness of the seismologists' information about dangerous seismic ground movements. As a result, we have clarified the fact that qualitatively different principles, measures and designs are needed to protect buildings from shock waves. The development and experimental testing of new protective designs for buildings of any type and constructional design (both planned and already existing ones) have already begun.

#### BIOTECHNOLOGY

#### Isolation and Properties of Human Blood Plasma Superoxide Dismutase

947C0112A Moscow BIOKHIMIYA in Russian Vol. 57 No. 12, Dec 92 pp 1892-1902

[Article by Ye.Ye. Dubinina, V.V. Turkin, G.A. Babenko, V.A. Isakov, Pediatric Medical Institute and State Physicians Advanced Training Institute imeni S.M. Kirov, St. Petersburg; UDC 577.152.3]

[Abstract] The high antioxidant activity of biological liquid in general and human blood plasma in particular due to the role of various high- and low-molecular compounds has been attributed to the antioxidant protection (AOZ) mechanism of the blood plasma which is realized due to its ability to retard metal-dependent free-radical reactions involving the development of OH radicals. Yet speculations that nonenzymatic antioxidant protection whose action is directed at lowering the active oxygen form (AOF) is active in the blood plasma while enzymatic antioxidant protection is triggered under a deep oxidative stress where superoxide dismutase (SOD) is the key antioxidant protection enzyme prompted the development of a method of purifying superoxide dismutase from human blood plasma and carrying out a comparative analysis of the purified enzyme and Cu- and Zn-superoxide dismutase erythrocytes. To this end, superoxide dismutase was measured by Nishikimi's method with Fried's modifications, and the superoxide anion radical was generated in a system consisting of NADH, phenasinemetasulfate (FMF), and tetrazolium nitro blue. The experimental procedure is outlined. Superoxide dismutase was isolated by gel filtration on AsA-34 and AsA-44 ultrogels made by LKB (Sweden). The protein isolated from blood is classified as glycoprotein which is thermally stable up to a 75-85° temperature; its molecular mass immediately after filtering was equal to about 147,000 D. A comparative analysis of the effect of some compounds capable of forming chelate complexes with metals contained in the active enzymes on the plasma and erythrocyte superoxide dismutase activity shows that the purified enzyme's properties differ from those of Cu- and Zn-superoxide dismutase and that the enzyme belongs to a new class of extracellular superoxide dismutase present in the organism's biological fluids. It is speculated that under a marked oxidative stress, superoxide dismutase plasma passes to an active state, making it possible to trigger the enzymatic protection mechanism and engage them in neutralizing active forms of oxygen. Figures 6; tables 3; references 32: 9 Russian, 23 Western.

#### Monoclonal Antibodies to Bacillus Macerans Cyclodextrin Glycosyl-Transferase

947C0112B Moscow BIOKHIMIYA in Russian Vol. 56 No. 11, Nov 91 pp 2069-2076

[Article by E. Arbatova, M. Reeben, A. Koestner, Tallinn Engineering University and Chemical and Biological Physics Institute at Estonian Republic's Academy of Sciences, Tallinn; UDC 577.122]

[Abstract] The unique ability of cyclodextrin glycosyltransferase (CGTase, EC 2.4.1.19) to form cyclodextrins-carbohydrate macrocyclical compounds-from starch and the high commercial and research value of cyclodextrins prompted an attempt to produce and characterize antibodies to the Bacillus macerans CGTase without known monoclonal antibodies to this enzyme. It is noted that poly- and monoclonal antibodies to CGTase may be used for detecting small quantities of enzyme, even in complex mixtures, and for enzymatic inactive studies of the CGTase molecular structure comparative immunology analyses of CGtases of various bacteria species, and for specific enzyme immobilization on a solid carrier, making it possible to screen a broad range of microorganisms which are likely CGTase producers. To this end, a Bacillus macerans BKMB-506 strain with the culturing liquid was obtained from the national microorganism collection of the Microorganism Biochemistry and Physiology Institute at the USSR Academy of Sciences. The experimental procedure is outlined. The production and cloning of the hybridomaproducing antibodies to CGTase, the production of large quantities of MCAs and their purification, the production of MCAs conjugated with horse radish peroxidas. studies involving indirect, direct, and sandwich enzymatic immunoassay analyses (IFA), the classification of MCA subtypes, and immunoblotting of the 5B1 clone (one of 15 positive clones) are described in detail. The purified enzyme was used to immunize BALB/c line mice; as a result, MCAs and 15 different hybridoma which produce MCAs to CGTase are successfully produced for the first time. The MCA and polyserum interaction with alkalophilic B. macerans CGTase is examined. The MCA to the 5B1 clone recognizes both native and denatured B. macerans CGTase forms. Moreover, the CGTase dimer molecule has two closely positioned epitopes recognized by antigens to the 5B1 clone. Figures 3; references 17: 3 Russian, 14 Western.

#### **Breathing Control Under Altered Gaseous Medium Density During Muscular Work**

947C0112C Moscow FIZIOLOGICHESKIY ZHURNAL SSSR IMENI I.M. SECHENOVA in Russian Vol. 78 No. 3, Mar 92 pp 14-25

[Article by M.O. Segizbayeva, G.I. Isayev, Respiration Physiology Laboratory at the Physiology Institute imeni I.P. Pavlov, St. Petersburg; UDC 612.28+612 014.41: 612.7]

[Abstract] Reports that nitrogen substitution with the inert and less dense helium lowers resistance and facilitates respiratory muscle work and the reverse effect of air substitution with an SF<sub>6</sub>-oxygen mixture prompted an investigation into the characteristic features of breathing control during inhalation of normotoxic helium- and SF<sub>6</sub>-oxygen mixtures at rest and during constant muscular activity on the basis of analyzing rapid and stable changes in the ventilation and biomechanical parameters of the respiratory system and the level of the central inspiratory activity. To this end, ten healthy 22-42 year

old men, trained beforehand in order to adapt them to the experimental conditions until full stabilization of the indicators under study, were examined using He and SF. as the diluent gases changing the respiratory mixture density at a 20.9+/-0.5% oxygen concentration. The SF<sub>6</sub>-O<sub>2</sub> density exceeded that of air by 4.21 times and the He-O<sub>2</sub> density was less than that of air by 2.94 times. The experimental procedure is outlined. The study shows that at rest and especially during muscular work, air substitution with the He-O<sub>2</sub> mixture suppresses the central inspiratory drive, respiratory work, and electric activity of the inspiratory muscles while inhalation of the SF<sub>6</sub>-O<sub>2</sub> mixture definitely has an opposite effect: the effort for developing an level lower maximum inspiratory flow at a constant pulmonary ventilation (compared to air) and a constant chemoreceptor stimulus rises while the central inspiratory activity increases by almost threefold. It is speculated that afferent signals from the respiratory muscles' mechanoreceptors which maintain the necessary alveolar ventilation within a broad range of mechanical stress play a crucial role in optimizing the ventilation regime in humans in gaseous media with different density while the ability to assess the stress imposed on the system is maintained even in patients with a traumatic severance of the spine in the neck area. Consequently, participation of the nonmuscular afferents in the respiration resistance perception cannot be completely ruled out, yet an analysis would call for a different experiment design and new methodological techniques. Figures 4; tables 2; references 33: 8 Russian, 25 Western.

# Effect of Delta Sleep Inducing Peptide on Seizure Activity

947C0112D Moscow FIZIOLOGICHESKIY ZHURNAL SSSR IMENI 1.M. SECHENOVA in Russian Vol. 78 No. 5, May 92 pp 17-23

[Article by A.A. Shandra, L.S. Godlevskiy, A.M. Mazarati, A.A. Oleshko, I.I. Mikhaleva, Normal Physiology Department at the Medical Institute imeni N.I. Pirogov, Odessa, and Peptide Chemistry Laboratory at the Scientific Research Institute of Bioorganic Chemistry imeni M.M. Shemyakin at Russia's Academy of Sciences, Moscow; UDC 612.821.7+616.853+557.15/.17]

[Abstract] The ability of the delta sleep inducing peptide (DSIP) to activate the brain's GABA-ergic inhibitory system prompted a study of the effect of the delta sleep inducing peptide on various forms of seizure activity characterized by a loss of inhibitory control. To this end, the effect of the delta sleep inducing peptide on the focal and generalized seizure activity and a model of chronically elevated seizure activity, i.e., the pharmacological kindling, are investigated. The particular problem of examining the effect of the delta sleep inducing peptide on the seizure activity when it is injected intravenously and determining the delta sleep inducing peptide concentration in the central mesencephalon segment which includes the reticular section of the substantia nigra under the condition of chronic seizure syndrome in rats which is

formed by pharmacological kindling and is characterized by disintegration of endogenous control of brain stimulation and spastic readiness is addressed. The experiment is carried out on 20 2.2-3.5 kg cats, 280-320 g male Vistar rats (with at least ten animals in each group) and 18-24 g F-1/CBAXC57B1/6 mice (at least ten). The experimental procedure is outlined. The experiment shows that the delta sleep inducing peptide is capable of inhibiting the seizure activity in the foci created in the cortex of cats by strychnine application, developing a delayed seizure kindling syndrome in rats, and preventing the development of seizures in mice induced by bicucullin, pycrotoxin, and corazol but has no such effect on thiosemicarbazide and strychnine. The study reveals that the delta sleep inducing peptide's anticonvulsant activity is due to its effect on the reticular section of substantia nigra whereby the peptide level terminates is that section at the late stages of pharmacological kindling. It is speculated that this peptide may be one of the factors of endogenous control of the brain excitability. The findings demonstrate that the peptide and the preparations on its basis may be useful in developing new methods of cupping off and preventing the convulsion syndrome. Figures 2; tables 1; references 23: 7 Russian, 16

## Mathematical Model of Electric Potential in Viral Ion Channels

947C0108A Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 18 No. 5, May 92 pp 613-617

[Article by L. Sastre (deceased), B. Llorente, R. Coroas, Cuban National Center for Scientific Research, Organic Synthesis Institute at the Latvian Academy of Sciences, Riga, and Havana University Department of Mathematical Cybernetics; UDC 578.324.087:591.181]

[Abstract] The ion exchange process occurring by means of ion channels in the cell membrane and the recently discovered ion channels in viral protein shells (capsides) which consist of base structural building blocks referred to as protomers linked by polypeptide chains are discussed, and it is speculated that chemical substances with the specific effect of blocking the viral or bacterial ion channel can be found. Such mechanism, if found, could make it easier to identify viral infection protection mechanisms. A mathematical model developed for designing substances with the desired ion channel blocking property which makes it possible to examine how some ions or molecules affect the state of ion channels is proposed assuming that the kinetic energy of the transported ions can be ignored. The underlying principles and realization of the mathematical model as well as its applications to the South American bean mosaic virus for Ca2+ and Li+ ions are described in detail. The Ca2+ and Li+ ion trajectory inside the ion channel and the electric potential magnitude at the Ca<sup>2+</sup> and Li<sup>+</sup> ion trajectory points are plotted. The findings show that a potential barrier arises in the path of the calcium ion but does not in the case of the lithium ion, which is consistent with Silva, Cacheau, et al. Figures 2; references: 12 Western.

#### Computer Analysis and Comparison of Snake and Radianthus Macrodactylus Sea Anemone Neurotoxin Structures

947C0108B Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 18 No. 5, May 92 pp 618-622

[Article by I.I. Parilis, Ye.Yu. Kazanov, R.S. Salikhov, D.Kh. Khamidov, Biochemistry Institute of the Uzbek Republic Academy of Sciences, Tashkent; UDC 577.112.5.087]

[Abstract] The issue of comparing homologic protein molecules in order to construct a philogenetic tree and the shortcomings of the methods used for this purpose are outlined, and known attempts to define and measure the distances for each pair of amino acid sequences of the proteins under study are reviewed. The outcome of computer methods of comparing the proteins under study on the basis of the pairwise distance are used to classify proteins by their main function, identify new proteins, and reconstruct the evolutionary history of the proteins under comparison in the form of philogenetic trees using any existing algorithm. For illustration, sea anemone toxins are compared to other toxins separated from the snake venom and equine, duck, rat, and human proinsulins. Based on the maximum total scores, Radianthus macrodactylus toxins are closest to long neurotoxins whose classification scoring points are analyzed on the basis of the pattern recognition theory. Pair Euclidean distances for 22 proteins from four groups, the concentration of informative amino acid residues and classification scores for snake toxins, and a comparison of Radianthus macrodactylus toxins RTX-I and RTX-V to snake neurotoxins and cytotoxins are summarized in a tabular form. The sample of ten A2 phospholipases is divided into two groups according to the organisms they represent using the newly introduced distance. An original application software package developed by the authors for comparing the proteins by their amino acid composition is described. It is available for purchase from the developers. Tables 3; references 14: 10 Russian, 4 Western.

# Effect of Snake Venom's Toxic Components on Substance P Binding to Rat Brain Membrane

947C0108C Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 18 No. 5, May 92 pp 635-639

[Article by Yu.N. Utkin, I.Ye. Kasheverov, V.I. Tsetlin, Bioorganic Chemistry Institute imeni M.M. Shemyakin at Russia's Academy of Sciences, Moscow; UDC 577.175.82+61282.015]

[Abstract] The phenomenon of joint localization of classical and peptide neurotransmitters which enables the receptor to interact with its own specific ligand and ligands which are specific to other receptors—which may lead to a modulating effect on the receptor activity—and the recently discovered effect of substance P (SP) on the binding characteristics and functional properties of the nicotine acetyl choline receptor (AKhR) prompted an examination of the effect of various acetyl choline

receptor ligands on the binding of iodized substance P to tachykinin receptors (TKhR) in the rat brain. The study shows that such compounds as d-tubocurarine and phencyclidine inhibit the SP binding but only at sufficiently high concentrations (10<sup>-4</sup> M). Thus, ion exchange HPLC is used to purify α-neurotoxins, κ-bungarotoxins, cytotoxins, and A2 phospholipases of snake venom. Phospholipases A2 have the highest ability to inhibit the substance P binding by the rat brain membrane while the remaining toxins are weak inhibitors. The high inhibitory potential of α-bungarotoxin discovered earlier is attributed to contamination of commercial preparations with phospholipase A2. The high sensitivity of the SP interaction with tachykinin receptors to phospholipases A<sub>2</sub> is especially noteworthy due to the fact that various phospholipases A2, including brain enzymes, are activated by a number of G-proteins connected to Gprotein-dependent receptors. It is speculated that cell phospholipases are capable of specifically interacting with Na+- and K+-ATPase or annular lipids and serve as an endogenic regulator. Figures 2; tables 1; references 22: 4 Russian, 18 Western.

#### Sequence-Specific Modification of Nucleic Acids by Oligonucleotide Derivatives Containing Alkylating Group in Desoxyuridine C-5 Position

947C0108D Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 18 No. 5, May 92 pp 640-645

[Article by V.F. Zarytova, A.S. Levina, L.M. Khalimskaya, Z.A. Sergeyeva, Novosibirsk Bioorganic Chemistry Institute at the Siberian Department of Russia's Academy of Sciences and Novosibirsk State University; UDC 547.963.32.07:577.113.6+577.113.4]

[Abstract] The use of oligonucleotide receptors containing alkylating groups in their structure for sequencespecific nucleic acid modification, usually attached to the terminal phosphate or 2',3'-cis-diol group and the use of oligonucleotide derivatives with modifying groups attached to the heterocyclic base (which may be spatially close to the nucleic acid target) are discussed, synthesis of 4-(N-methyl-N-2-chlorethylamino)benzyl heptanucleotides derivatives is described for the first time, and their affine modification of pentadecanucleotide is investigated. The heptanucleotides containing an aliphatic amino group at the 5'-terminal attached in the desoxyuridine 5-position through L-spacers of various length were synthesized according to Zarytova, Komarova, et al. The phase conjugation chromatography (OFKh) pattern of the reaction products after the derivative synthesis and an electrophoresis pattern of the target alkylation products are plotted. The 4-(N-methyl-N-2-chlorethylamino)benzyl radical (RCl) was added with the help of a derivative benzaldehyde reaction with the heptanucleotide amino group. A new type of alkylating derivatives of oligonucleotides which carry the RCl group in the C-5 desoxyuridine radical and ensure a high degree of DNA target modification is

produced. ULNHRCICCACTT reagents (L is -CH<sub>2</sub>-, -CH<sub>2</sub>OCH<sub>2</sub>CH<sub>2</sub>-, or -CH<sub>2</sub>NHCOCH<sub>2</sub>CH<sub>2</sub>-) are synthesized and then used to modify the target with an 80-90% effectiveness. The findings show that the third reagent with the L=-CH<sub>2</sub>NHCOCH<sub>2</sub>CH<sub>2</sub>-spacer ensures an almost quantitative modification of the target at one particular point which is usually not observed for oligonucleotide derivatives with the RCl radical attached to the terminal phosphate of ribose's 2',3'-cis-diol group. Figures 3; references 15: 6 Russian, 9 Western.

# Synthesis of Artificial Gene Encoding Thymosin $\alpha_1$ and its Expression in *Escherichia Coli* as Fusion Proteins With Human Tumor Necrosis Factor

947C0108E Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 18 No. 5, May 92 pp 646-659

[Article by V.G. Korobko, Ye.F. Boldyreva, S.A. Filippov (deceased), S.G. Popov, S.I. Yevsegneyev, L.V. Nosova, Bioorganic Chemistry Institute imeni M.M. Shemyakin at Russia's Academy of Sciences, Moscow; UDC 547.963.320.57:577,214.622]

[Abstract] The powerful general immunostimulating activity of thymosin a<sub>1</sub>—one of more than 30 peptides with a low molecular mass of 1,000 to 15,000 isolated from the thymus—which is synthesized in the body in the form of a precursor from which it is cleaved off prior to N-terminal acetylation, and the shortcomings of known thymosin  $\alpha_1$  synthesis gave an impetus to designing a hybrid gene using a carrier which encodes a small-sized protein which does not contain methionine residues and is easily expressed in bacterial cells. Chemical enzymatic synthesis and cloning of an artificial gene in E. coli which encodes the immunoactive peptide thymosin  $a_1$  is reported. The semisynthetic gene of the mutant human tumor necrosis factor (TNF) in the pTNF3314 plasmid used earlier to construct hybrids with antigen determinants of the foot and mouth disease virus which contains a unique BamHI restrictase site in the C-terminal part meets all of the necessary requirements. A preliminary investigation of the biological properties of recombinant fusion proteins shows that the Thy-TNF fusion protein is characterized by complete biological activity of the tumor necrosis factor in a cytotoxicity test on transformed fibroblasts of L-929 mice while the TNF-Thy fusion protein is considerably less active. The findings confirm the earlier conclusions about the important role played by the C-terminal TNF segment in the biological (cytotoxic) activity manifestation. Thus, artificial genes which encode the TNF and thymosin a, hybrids are constructed, and their expression in E. coli and the properties of the proteins encoded

by them are examined. The cytotoxicity of the fusion proteins is determined according to Meager, Leung, et al. The authors are grateful to V.Ye. Zhemchugov, O.A. Kaurov, A.A. Kolobov, and V.A. Kulikov for proving assistance and supplying the serum. Figures 7; references 26: 6 Russian, 20 Western.

# Human Interleukin-4 Synthetic Gene Expression in Escherichia Coli Cells. Biologically Active Protein Isolation

947C0108F Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 18 No. 5, May 92 pp 660-670

[Article by N.V. Batchikova, M.A. Kulagina, S.V. Lutsenko, V.A. Smirnov, V.Yu. Kanevskiy, L.A. Ryazanova, I.V. Nazimov, N.V. Sinina, Ye.A. Sinyagina, A.V. Azhayev, Bioorganic Chemistry Institute imeni M.M. Shemyakin at Russia's Academy of Sciences, Moscow; UDC 577.112]

[Abstract] The role of human interleukin-4 as a growth and immune system cell differentiation stimulant which regulates the immune response and the difficulty of obtaining large quantities of interleukine-4 necessary for in depth studies and practical applications from natural sources make the use of genetic engineering and biotechnology methods especially promising. Chemical enzymatic synthesis of the human hIL4 gene at the Bioorganic Chemistry Institute lab is reported and this gene's expression in E. coli cells is described. The pKK223-3 commercial plasmid (by Pharmacia) containing a strong controlled tac-promotor, a binding segment with ribosomes of the lacZ gene, EcoRI-HindIII polylinker of the pUC18 plasmid, and a strong transcription terminator of the rrnB gene is used as the expression vector while the EcoRI-HindIII fragment containing the hIL4 gene is cloned into the pKKhIL4-12 polylinker segment. The factors which affect the gene expression are examined, and it is noted that the expression level depends on the distance between the ribosome binding segment (RBS) and the starting ATG codon. The resulting TG1/ pKKhIL4-9 strain was used to isolate hIL4 which is produced in the E. coli bacterial cells in the form of insoluble inclusion bodies. The highest production level is observed in the structure where the RBS distance corresponds to nine nucleotide pairs. The hIL4 was solubilized, renatured, and purified in a biologically active state with a yield of 2 mg per 1 g of moist cells. According to amino acid sequencing data, the resulting hlL4 has an N-terminal Met-His-Lys-Asp-He-Thr-Leu sequence which is consistent with the human interleukin-4 sequence with an additional Met. Figures 8; tables 1; references 14: 2 Russian, 12 Western.

#### Identification of Substance P Receptor Gene Fragment in Human Genome DNA Using Polymerase Chain Reaction

947C0108G Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 18 No. 5, May 92 pp 740-743

[Article by A.A. Barinov, A.B. Kuryatov, I.B. Mertsalov, L.O. Martsen, V.I. Tsetlin, Bioorganic Chemistry Institute imeni M.M. Shemyakin at Russia's Academy of Sciences, Moscow; UDC 577.214.3]

[Abstract] Substance P (SP) and kindred peptides which form a family of the so-called tachykinins or neuroquinines and possess a broad range of biological activity, e.g., affect of the nonstriated muscle contractility, play the role neuromediators, participate in transmitting pain signals, and affect the level of classical neuromediators and cytokins, are discussed, and the need to clarify the structural-functional relationships of tachykinin receptors is emphasized. To this end, an attempt is made to establish the structure of the maximum possible number of proteins in this family, including human receptors. The emergence of the polymerase chain reaction method (PTsR or in vitro amplification) facilitates identification and makes it easier to establish the structure of genes belonging to one family. Success in isolating a kDNA human fragment with the help of polymerase chain reaction and primers synthesized on the basis of the NK-2 receptor gene nucleotide sequence from the bull intestine in using a human trachea mDNA is reported, and polymerase chain reaction is used to identify the substance P receptor gene (NK-1 receptor) in the human genome. Primer pairs whose nucleotide sequences are identical to conservative segments of DNA receptor areas of the rat brain substance P are synthesized, and the resulting polymerase chain reaction products are analyzed using electrophoresis. The resulting fragment is identical to the 771-864 fragment of the nucleotide sequence of the rat brain substance P receptor except for the G<sup>796</sup>→A substitution, i.e., a Val-Ile substitution in the amino acid sequence. A comparison to published sources reveals that the established nucleotide sequence corresponds to tachykinin receptors and is a fragment of the substance P receptor gene. The authors are grateful to N.S. Bystrov for oligonucleotide probe synthesis. Figures 2; references: 11 Western.

#### Synthesis of Oligodesoxyribonucleotides Containing 5-Fluoro-2'-desoxyribocytidine

947C0108H Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 18 No. 5, May 92 pp 748-750

[Article by Ye.A. Kubareva, Ye.A. Romanova, T.S. Oretskaya, Ye.S. Gromova, Z.A. Shabarova, Chemistry Department of the Moscow State University imeni M.V. Lomonosov; UDC 547.963.32.057:542.95]

[Abstract] The development of synthesis of oligodesoxyribonucleotides containing 5-fluoro-2'-desoxyribocytidine (fl<sup>5</sup>Cyd) which are a promising source for understandding mechanism of cytosine DNA-methylases is described in detail. The resistance of 5'-O,N-protected fl<sup>5</sup>Cyd under the conditions of standard postsynthesis oligonucleotide treatment is examined, and it is shown that exposure of such protected fl<sup>5</sup>Cyd to concentrated ammonia at 55°C for 18 h with subsequent exposure to an 80% aqueous solution of acetic acid at 20°C for 40 min removes the protective groups without altering the fluoridated nucleoside structure. It is speculated that the absence of benzoyl amino group protection makes the nucleoside more stable to subsequent acid treatment. The findings show that oligonucleotides containing fl<sup>5</sup>Cyd in the middle of the chain can be produced rather simply and effectively by a combination of chemical and enzymatic synthesis; this method can be used for producing oligonucleotides not only with a single fl<sup>5</sup>Cyd radical inclusion but also with several fl<sup>5</sup>Cyd radicals spaced from each other by six-to-seven nucleotide links by ligating several oligonucleotides with 5'-terminal fl<sup>3</sup>Cyd. The authors are grateful to V.N. Sergeyev, V.N. Tashlitskiy, and G.Ya. Sheflyan for help with isolating and analyzing oligonucleotides. Figures 1; references 11: 2 Russian, 9 Western.

#### Palytoxin Isolation From Radianthus Macrodactylus Sea Anemone

947C01081 Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol. 18 No. 5, May 92 pp 751-752

[Article by V.M. Makhnyr, E.P. Kozlovskaya, Pacific Bioorganic Chemistry Institute at the Far Eastern Department of Russia's Academy of Sciences, Vladivostok; UDC 577.11]

[Abstract] The potential of using Radianthus macrodactylus sea anemones as a source of physiologically active substances and the failure to isolate neurotoxins with a nonprotein origin from Radianthus macrodactylus sea anemones prompted attempts to isolate highly active nonprotein toxins from tropical sea anemones. The toxin was isolated by chromatography on polytetraflourethylene, CM-sephadex C-25, and HPLC ion exchangers in Ultropac TSK CM-3SW and Ultropac TSK DEAE-3SW columns. This toxin was firmly sorbed by the hydrophobic agent Polychrome-I and interacted weakly with cation- and anion-exchange substances at a pH of 5.0 and 7.4, respectively. The toxin's nonprotein origin was confirmed by the negative outcome of a test for Nterminal amino acid and amino acid analysis. It is shown that the palytoxin molecule's trans-3-aminoacrylamide fragment which is responsible for the 263 nm peak in the ultraviolet spectrum is unstable both in acidic and alkaline media. For intravenous injection in mice, the toxin's LD<sub>50</sub> is 74+/-0.29 µg/kg. It is speculated on the basis of the substance's high toxicity as well as spectroscopy data that it is the same palytoxin which was isolated for the first time from Palythoa toxica zoanthid. The authors are grateful to T. Balashova and A.I. Kalinovskiy for recording the 500 MHz NMR spectra and discussing the spectrum patterns. References: 7 Western.

#### Oligonucleopeptides. II. Oligonucleotidyl-(PN)-Peptide Synthesis Using Redox Agent—Mixture of Triphenylphosphine and 2,2'-Dipyridylsulfide

947C0109A Kiev BIOPOLIMERY I KLETKA in Russian Vol. 8 No. 5, Sep-Oct 92 pp 16-20

[Article by S.N. Yarmolyuk, L.S. Korol, I.V. Alekseyeva, A.S. Shalamay, Molecular Biology and Genetics Institute at the Ukrainian Academy of Sciences, Kiev; UDC 547.963.32:466.057]

[Abstract] The use of phosphamide nucleopeptides for simulating the protein-nucleic structure bonds and the use of oligonucleopeptides (the prefix "desoxy-" is omitted in the oligonucleopeptide (ONP) designation) as chemical probes, markers, and affine agents prompted a search for highly efficient and specific selective reagents for their synthesis. In the authors' opinion, the redox condensing agent—a mixture of triphenylphosphine (Ph.P) and 2,2'dipyridylsulfide (Py<sub>2</sub>S<sub>2</sub>)—which was used for making oligonucleopeptide phosphamines meets these requirements. An attempt is made to analyze the course of the reaction and the formation of byproducts as well as outline the bounds of redox condensing reagent (AVKR) applications for producing oligonucleotidyl-(P-N)-peptides. The source materials and synthesis procedure in the presence of various nucleophilic catalysts are discussed in detail. The study shows that the reaction is especially sensitive to strong bases and terminates in the their presence by forming a symmetric pyrophosphate. The use of the redox condensing agent without the catalyst makes it possible easily to phosphorylate the weak-base amines while the catalyst retards the reaction with them and facilitates it with more basic amines. The best results are obtained with peptides whose pKa≤9. The findings confirm that synthesis occurs with the formation of a phosphamide bond both in the 3' and 5' oligonucleotide position. Both nucleophilic catalysts and the basic properties of peptide amino groups as well as the end phosphate position directly affect the course of the reaction and the oligonucleopeptide and byproduct formation. Figures 2; tables 3; references 17: 10 Russian, 7 Western.

#### Plasmid DNA Screening in Microorganism Strains Used for Industrial Enterprise Waste Water Treatment

947C0109C Kiev BIOPOLIMERY I KLETKA in Russian Vol. 8 No. 5, Sep-Oct 92 pp 54-56

[Article by T.N. Shevchenko, A.V. Roy, A.Yu. Miryuta, N.A. Klimenko, T.P. Pererva, Molecular Biology and Genetics Institute at the Ukrainian Academy of Sciences, Kiev, and Colloidal Chemistry and Water Chemistry Institute at the Ukrainian Academy of Sciences, Kiev; UDC 577.21]

[Abstract] The environmental and economic tasks of industrial enterprise waste water treatment with the help of various microorganism strains and the urgency of finding off-chromosomal genetic determinants of the biological degradation process prompted the screening of plasmid

DNA in the strains separated from industrial enterprise waste water. To this end, Ps. putida, Ps. alcaligenes, B. subtilis strains from the collection of the Voodoobrabotka Research center are used. The microorganisms were grown a salt medium. The study demonstrates that the strains capable of utilizing surface active substances contain plasmid DNA yet with respect to urea, this property does not correlate with the presence of plasmids. It is speculated that it is coded by chromosomal genes. The findings open the possibility of developing vector molecules for B. subtilis on the basis of the pMA9 and pMA10 plasmid genomes. A comparison to published data makes it possible to note that plasmids DNA participating in the biodegradation of ampholytic surfactants are detected in a number of Ps. putida strains. The importance of separating the direct genes which determine biodegradation of syntanol is stressed. Figures 1; references 3: 2 Russian, 1 Western.

#### Role of Ca<sup>2+</sup> and Cyclic AMP Ions in Nerve Cell's Electric Response Generation to Antigen Application to Brain Proteins

947C0092A Moscow BIOLOGICHESKIYE MEMBRANY in Russian Vol. 10 No. 1, Jan-Feb 93 pp 30-35

[Article by Ye.l. Solntseva, Brain Research Institute at Russia's Academy of Medical Sciences, Moscow; UDC 612.829:612.822:577.352.5]

[Abstract] Interest in biochemical and electric responses of the nerve cell to application of antibrain antibodies is attributed to the fact that such reactions serve as the biological basis of nervous and psychological disorders, and data on the intracellular mechanisms of the nerve cell's electric activity behavior under the effect of antibrain antibodies are reviewed. In particular, the electrophysiological effects of immunoglobulines (Ig) and blood serum of schizophrenia patients, electrophysiological effects of antibodies to S-100 proteins, i.e., AS-100 or genusnonspecific proteins present in the glia or neurons both in the soluble and membrane-bound form, and the role of intracellular mediators in AS-100's electrophysiological effects are examined in detail. A study involving snail and rat hippocampal neurons shows that these antibodies suppress the action potential generation with or without the membrane depolarization, decrease the membrane's input resistance, and lower the amplitude of stimulating postsynaptic potentials. AS-100 lowers the potential-dependent inward current and induces steady-state inward current, yet these phenomena can be neutralized fully or partially by intracellular EGTA Ca2+-chelator or cAMP injection. Under the effect of antibrain antibodies on the nerve cell, events develop in its cytoplasma which are similar to those occurring in the cytoplasma of immunocompetent cells during the antigen-antibody complex formation in them. It is speculated that AS-100's electrophysiological effect is due to an increase in the Ca2+ level and a decrease in the cAMP level in the nerve cell's cytoplasma. It is further speculated that these antibodies are also capable of inducing similar effects in human brain neurons and leading to significant shifts in the psychic status. Figures 1; references 35: 14 Russian, 21 Western.

Construction of Strains Producing FI- and T-Antigens to Plague Microbe

947C0098A Moscow BIOTEKHNOLOGIYA in Russian No. 6, Nov-Dec 92 pp 59-62

[Article by I.V. Darmov, I.V. Marakulin, S.N. Yanov, A.A. Byvalov, T.G. Abdullin, Ye.V. Smirnov, Scientific Research Institute of Micro-biology at the Russian Ministry of Defense, Kirov; UDC 575:577.21]

[Abstract] The marked protective action of the Ifraction, also referred to as FI-antigen, to the plague microbe is well known; atypical forms of the Yersinia pestis agent which do not synthesize the I-fraction and are found in natural foci can usually be produced from preparations on the basis of antibodies to the mice toxin or T-antigen. Consequently, an attempt is made to construct special producer strains of FI- and Tantigen to the plague microbe using genetic engineering methods. To this end, pFra/Tox plasmid DNA are isolated from the monoplasmid version of the K-I vaccine strain of Y. pestis, and cloning is performed in the cells of strain 803 of Escherichia coli using the pBR328 vector and cos36 (rep R1162) cosmids and a restrictase and DNA ligase set. The experimental procedure is outlined. The protective action of the purified preparations of the FI-antigen produced from recombinant strain cultures is assessed using conventional techniques, and statistical data processing is carried out according to Ashmarin and Vorobyev. The mice toxin gene is cloned on the pBR328 vector in the HindIII-fragment (6.0 MD) of the pFra/Tox plasmid. An in vitro deletion mutagenesis analysis shows that the sequence encoding the mice toxin has two Bgl II sites and one Eco RI site. Hybrid pKT328 plasmid is considerably more stable compared to the pBR328 vector. A restriction chart of the 30.3 kD long pFra/ Tox genome area which houses the fra and tox genes is plotted, and it is established on the basis of the diffusion precipitation reaction in agar that the recombinant E. coli strain cells produce no more than two units of T-antigen (mice toxin). The area responsible for the incompatibility of the pFra/Tox plasmid and correct distribution of its copies among the daughter cells is identified. The results make it possible to state that by increasing the gene dose and expression level of the cloned gene, FI- and T-antigen producing strains which are distinguished by a stably high synthesis level and the absence of a number of contaminating antigens have been constructed. The recombinant strain cells produced from Y. pestis EV (3P-) and Yersinia pseudotuberculosis PI produce four-to-eight times more FIantigen than the cells of the NIIEG line, while purified FI-antigen preparations produced from the recombinant strains' cultured liquid (KZh) have at least as high a protective ability as the preparation isolated from NIEEG strains. Figures 3; tables 4; references 16: 12 Russian, 4 Western.

L-Lysine Biosensor Based on pCO<sub>2</sub> Conductometric Sensor

947C0098B Moscow BIOTEKHNOLOGIYA in Russian No. 6, Nov-Dec 92 pp 63-68

[Article by S.G. Ignatov, S.N. Andreyev, S.F. Dragunova, National Scientific Research Institute of Applied Microbiology, Obolensk, Serpukhov rayon, Moscow oblast; UDC 547.466.461

[Abstract] The urgency of measuring the lysine concentration in commercial production and clinical analyses and the complexity of existing enzyme immobilization methods necessitated the development of a simple method of immobilizing the enzyme on a cellulose membrane in order to detect lysine with the help of a conductometric pCO2 electrode. To this end, L-lysine decarboxylase (UII type from E. coli) made by Sigma (U.S.) and Vladipor No. 1 cellulose membranes are used. The enzyme electrode preparation method and a block diagram of the L-lysine concentration measurement circuit are cited, and the dependence of the L-lysine sensor activity on pH and the effect of the measurement temperature on the lysine sensor sensitivity are plotted. The enzyme optimum operating conditions fall within pH=5.5-6.0; a decrease in pH increases the biosensor sensitivity, but lower pH values inhibit the enzymatic activity. The optimum operating temperature is 37°. The sensor is characterized by a linear response within a 0.4-8 mM concentration range. In addition to lysine detection, the proposed sensor may be used for other chemicals, e.g., chlorophos. Figures 3; references 6: 2 Russian, 4 Western.

Saccharose Inversion by Zymomonas Mobilis Culture Immobilized in Polyelectrolyte Hydrogel

947C0098C Moscow BIOTEKHNOLOGIYA in Russian No. 6, Nov-Dec 92 pp 69-73

[Article by Ye.K. Dragalova, A.K. Yalynskaya, T.V. Galushko, D.A. Topchiyev, Petrochemical Synthesis Institute imeni A.V. Topchiyev at Russia's Academy of Sciences, Moscow, and Microbiology Institute at the Latvian Academy of Sciences imeni A. Kirchenstein, Riga; UDC 575.224.232.4]

[Abstract] The limitation on the practical implementation of saccharose inversion by the Zymomonas mobilis culture in order to obtain such valuable products as fructose, glucose, alcohol, etc., and the urgency of developing "soft" micro-organism cell immobilization methods without lowering the cells' functional activity necessitated an attempt to increase the stability of the biocatalytic system by treating hydrogel particles on the basis of calcium alginate with Zymomonas mobilis cells immobilized in them by solutions of cationic polyelectrolytes capable of cooperatively forming interpolyelectrolyte complexes with polyanions. The Zymomonas mobilis 113 cell culture was grown for this purpose for 24 h in an aqueous nutrient medium. The experimental procedure and hydrogel production method are outlined.

A schematic diagram of the immobilizing unit is cited. and the saccharose inversion degree is summarized. In particular, the effect of the aqueous poly-N, N'-dimethyl-N, N'diallylammonium chloride (PDM-DAAC) solution in the Zymomonas mobilis cell viability and the effect of the Zymomonas mobilis culture concentration in the biocatalyst on the catalytic activity of the system within a 2-16% cell concentration range are examined. The findings show that treatment of calcium alginate hydrogel with immobilized Zymomonas mobilis 113 cells by an aqueous solution of the PDMDAAC cation polyelectrolyte results in the polyelectrolyte complex film (PEK) development on the gel particle surface; the film is polymer cation and anion complex insoluble in water. The polyelectrolyte complex film has the properties of a membrane, i.e., is permeable to low-molecular compounds such as saccharose and monosaccharide. The polyelectrolyte complex film membrane also prevents the immobilized cell release to the external solution, thus greatly increasing the biocatalytic system stability. Diffusion of saccharose and the reaction products inside the polymer matrix is the limiting stage of the saccharose inversion by the immobilized cells into the modified polyalginate hydrogel matrix. Figures 6; tables 1; references 6: 3 Russian, 3 Western.

#### Predictive Image Design of New Biotechnology Productions of Viral Preparations Based on Animal Cell Cultures

947C0098D Moscow BIOTEKHNOLOGIYA in Russian No. 6, Nov-Dec 92 pp 76-80

[Article by N.N. Belov, A.G. Bachinskiy, National Scientific Research Institute of Molecular Biology at the Vektor Scientific Production Association, Koltsovo, Novosibirsk oblast; UDC 57.083.22]

[Abstract] The shortcomings of long-range forecasting of biotechnology productions, particularly the formulation of specific trends of systemic development concepts, and the negative impact of the "corrective response" management practices prompted the development of a new approach based on a systemic representation of the prototype plant as an organically integral complex containing the hypothetical image of the biopreparation (BP) and the methods of its development and production. To this end, existing predicted entity classification approaches and forecasting methods are analyzed. A block diagram of step-by-step morphological analysis and a block diagram of the initial morphological culturing version matrix are cited, and the outcome of the culturing method assessment by the expediency criterion is summarized. The above step-by-step prediction procedure is suggested for use on the basis of morphological analysis and a group of expert methods; the procedure is tested in forming the predictive image of new biotechnology plants for producing viral preparations on the basis of animal cell cultures. The optimum version selection and rejection of dead-end versions are performed in three iterations. In particular, perfusion culturing in a membrane biological reactor or a reactors

with packed macrocarrier spheres are suggested. Figures 2; tables 1; references 20: 14 Russian, 6 Western.

# Design of Chromosome DNA Probe Species-Specific for Yersinia pestis

947C0198 Moscow GENETIKA in Russian Vol.29 No.3, Mar 1993 [manuscript submitted 06 Mar 92] pp 417-422

[Article by O. V. Norkina, A. N. Kulichenko, G. A. Shovodayeva, R. Kh. Boshnakov, M. Yu. Aksenov, Yu. A. Popov, A. Ts. Tomov, V. K. Kyesovskiy, I. G. Drozdov, A. L. Gintsburg, Antiplague Scientific Research Institute Mikrob, Saratov; Institute of Epidemiology and Microbiology imeni N. F. Gamaleya, Russian Academy of Medical Sciences, Moscow; Military Medical Academy, Sofiya, Bulgaria; UDC 575: 616.981.452]

[Abstract] A 14.8 kbp chromosomal DNA fragment, designated T16, was cloned from Yersinia pestis TWJ and a restriction map made of the fragment. T16 was tested with subfragments in dot hybridization with Y. pestis. Y. pseudotuberculosis, and Y. enterocolitica, as well as with enterobacteria such as shigella, salmonella, and various strains of intestinal bacilli. The fragment was used to construct a 980 bp DNA probe speciesspecific for Y. pestis. In a number of strains of the pseudotuberculosis microbe, the researchers found nucleotide sequences with a relative homology for Y. pestis. The restriction map indicates the absence of the EcoRI site of the CM fragment in the T16 sequence, suggesting either that the authors cloned DNA fragments similar to those cloned by Bardarov et al. (FEMS Microbiol. Lett., 1990, Vol.71, pp 277-280) or that there are structural differences in that region of DNA in the strains Y. pestis TWJ and EV. A nucleotide repeater was, indeed, found. Figures 2, references 15: 7 Russian, 8 Western.

#### Cloning Vectors for Escherichia Coli and Endorhizospheric Nitrogen Fixer Klebsiella Oxytoca VN13 Based on Replicon of Natural HSD Plasmid pZE8

947C0109B Kiev BIOPOLIMERY I KLETKA in Russian Vol. 8 No. 5, Sep-Oct 92 pp 48-53

[Article by M.F. Alekseyev, G.L. Kovtunovich, A.N. Kravets, A.S. Solonin, Molecular Biology and Genetics Institute at the Ukrainian Academy of Sciences, Kiev, and Microorganism Biochemistry and Physiology Institute at the Russian Federation Academy of Sciences, Pushchino; UDC 579,252.5]

[Abstract] The rapidly deteriorating environmental conditions increase the urgency of research into the genetics of nitrogen fixing microorganisms, both free living and endorhizospheric, which are capable of 1) cloning the plant vessel bundles, making them exceptionally competitive with respect to the soil microflora, and 2)

producing a natural plant growth stimulant, i.e., indolyl-3-acetic acid. The resulting attempts to clone pZE8 natural hsd plasmid replicon-based cloning vectors for Escherichia coli and endorhizosphere nitrogen fixer Klebsiella oxytoca VN13 are outlined. The source materials and cloning procedure are described in detail. The pKAS18 and pKAS19B vectors constructed on the basis of the replicon of the natural hsd Citrobacter freundii plasmid and the pUC18 and pUC19 polylinkers have a selective stability marker for kanamycine; tests show that that 96% Cm<sup>R</sup> and 98% Tc<sup>R</sup> of the resulting clones are stable to this antibiotic. The pMG1k and pMG21k plasmids are shown to be suitable fore cloning PstI DNA fragments, e.g., developing genome libraries of microorganisms; moreover, the pMG21k plasmid has unique restriction sites Smal/Xmal in the Kmr gene an Sall and EcoRV in the Tc<sup>r</sup> gene. The latter sites may be used for cloning employing direct recombinant molecule selection. The vectors are characterized by an elevated stability and are suitable for genetic engineering modification of Klebsiella oxytoca VN13 endorhizosphere nitrogen fixer. Figures 4; references 18: 9 Russian, 9 Western.

#### Ozone: New Aspect of Effects on Microorganisms

937C0129A Moscow DOKLADY AKADEMII NAUK in Russian Vol. 331 No. 1, Jul 1993 [manuscript submitted 12 Jan 93] pp 104-108

[Article by D. N. Ostrovskiy, M. A. Martynova, V. K. Matus, O. D. Ogrel, Ye. I. Lysak, Ye F. Kharatyan, L. A. Sibeldina, I. N. Shchipanova, Institute of Biochemistry imeni A. N. Bakh, Russian Academy of Sciences, Moscow; Institute of Photobiology, Academy of Sciences of Belarus, Minsk; UDC 576.8.577.15.049]

[Abstract] In addition to providing a protective shield for life on this planet, ozone is recognized as one of the most dangerous of anthropogenic toxicants in the atmosphere. The mechanism of action of ozone on microbial cells is the subject of intense debate. It is clear that most of the ozone, rather than penetrate the cell deeply, reacts with membranes and other surface structures to prevent the development of the microbe, thereby killing the microbe. Noting that other oxidants induce the in-cell formation of a new compound— 2-methylbutane-1,2,3,4-tetraol-2,4- cyclopyrophosphate in a number of bacteria, the researchers here chose to use ozone to determine whether the mechanism of action of that phenomenon hinges on an initial removal of electrons from the active centers of the enzymes containing NADPH or flavin, or on subsequent reduction of some group, or on the triggering of secondary oxidants formed after the singleelectron reduction of oxygen to a superoxide radical. The Gram-positive bacteria Brevibacterium ammoniagenes ATCC 6872, Micrococcus luteus of the Fleming 2665 strain, and Mycobacterium smegmatis VKM As-1171 were cultivated to the end of the logarithmic growth phase at 30°C in flasks with 200 ml of a medium containing 1 percent peptone, 0.3 percent yeast extract, and 0.5 percent NaCl. The cells were then ozonized, which produced ozone via electrosynthesis. The researchers found the most critical

feature of the mechanism of action to be the ozone-induced oxidative activation of enzymes for the synthesis of the new cyclopyrophosphate. Membrane permeability was, by and large, left intact, despite major changes in membrane lipids. Lengthy ozonization leads to the disappearance of intracellular ammonigenin hydroxylamine; with short-term exposure, however, redox status is preserved. Figures 3, references 15: 7 Russian, 8 Western.

#### Expression of Thermal Shock Proteins in Mycoplasma

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[Article by M. S. Voinskiy, G. V. Astvatsaturyants, S. N. Borkhsenius, Institute of Cytology, Russian Academy of Sciences, St. Petersburg; UDC 576.3]

[Abstract] One of the most frequently encountered stress factors in nature is rapid change in temperature, or thermal shock, which induces the expression of a system of thermal shock proteins in animals, plants, and microorganisms. Earlier, the researchers here demonstrated the expression of thermal shock proteins in mycoplasma, which has an extremely small genome and has no cell wall. Most types of mycoplasma populate mucosa surfaces in animals and man. In the work reported here, the researchers used labelling and immunoblotting with polyclonal antibodies to thermal shock proteins 60 and 70 to study expression of thermal shock proteins. The study involved A oleplasma laidlawii PG8, Mycoplasma pneumoniae FH, M. genitalium of the strain G-37 ATCC 33530, M. fermentans ATCC 19989, and M. fermentans of the incognitus strain. Cultures were grown at 32°C in a liquid medium to the middle of the exponential growth phase. Thermal shock was effected by changing the temperature to 42°C for two hours and then changing it back to 32°C for two hours. 35S-methionine was added after the change to 42°C. The cells were centrifuged, washed with a PBS solution, and stored at -70°C until they were taken out for use. The synthesis of thermal shock proteins in the A. laidlawii cells was accompanied by accumulation that was apparent 20 minutes after temperature elevation and was at its peak 1 hour after the elevation. Proteins p17, p65, and p72 were clearly identified on electrophoregram and in radioautography. Densitometry indicated that the quantity of base thermal shock proteins in the cells increased after thermal shock to 4.2 percent from 0.8 for p72 and to 4.8 percent from 0.05 for p65, which is comparable with thermal shock protein accumulation in E. coli. The A. laidlawii cells produced a large quantity of lowmolecular p17, which reached 7.2 percent of the total cell protein. Immunoblotting of proteins of several types of mycoplasma with polyclonal antibodies to total bacterial antigen showed that appreciable changes in thermal shock protein expression occurred in A. laidlawii and M. pneumoniae only. Figures 2, references 15: 1 Russian, 14 Western.

# EPIDEMIOLOGY, MICROBIOLOGY, AND VIROLOGY

Set of Dry Coagglutinating Diagnosticums To Detect and Identify Causative Agents of Dangerous Infectious Diseases

947C0236A Moscow ZHURNAL MIKROBIOLOGII, EPIDEMIOLOGII I IMMUNOBIOLOGII in Russian No. 2, Feb 92 (manuscript received 18 Mar 91) pp 71-72

[Article by G.M. Orlova, L.B. Adimov, O.V. Sibkova, V.V. Korol, and N.V. Bozhko, Rostov-na-Donu Antiplague Scientific Research Institute; UDC 616.9-078.33:615.373:616-078]

[Text] The reaction of coagglutination on glass, which is being used successfully to detect and identify bacteria, viruses, soluble antigens, and toxins, has gained widespread popularity in our country and abroad. The possibility of also using it to detect the causative agents of dangerous infectious diseases has also been demonstrated in principle (V.S. Rybkin, 1983; G.M. Orlova et al., 1986; Yu.A. Belaya, 1987; T.M. Grizhebovskiy, et al., 1987; O.V. Sivkova, 1988). Our industry does not produce the respective diagnosticums, however. Such preparations are also needed to detect and identify isolated cultures and conduct accelerated analyses, especially under field conditions, in emergencies, and during mass studies.

This communication is devoted to the development of plague tularemia, cholera, glanders, and melioidosis dry coagglutinating diagnosticums and to the study of their use in different stages of bacteriologic investigation.

Vaccine and virulent strains of bacteria of the respective species were used to prepare the antigens in the experiments, and strains of various heterologous microorganisms were used to study the resultant preparations' specificity. The optimum schemes of producing rabbit immune sera were selected for each diagnosticum. Dry commercial staphylococcal reagent (produced by the Leningrad Epidemiology and Microbiology Scientific Research Institute imeni Pasteur) were sensitized by using native sera in accordance with recommendations. The amount of sensitizing agent and duration of sensitization were selected individually for each diagnosticum. For a working dilution, researchers used a dilution equal to half the maximum resulting in a preparation efficiently agglutinating homologous antigens.

The liquid diagnosticums were lyophilized in a saccharose-gelatin medium. Equipment produced by Friger (Czechosolvakia) was used.

When setting up the reaction, researchers applied a drop of prepared microbial suspension onto clean degreased glass, added a drop of dissolved preparation, mixed it, and examined it against a dark background. They checked for the absence of spontaneous agglutination of the diagnosticum and suspension of study cultures. The result was calculated over 5 minutes; a response to 4+ and 3+ was considered positive.

Three versions of plague diagnosticums were developed on the basis of different sera, i.e., diagnosticums to whole live microbial cells of the vaccine strain EV 1290, to the somatic antigen (fraction V) of the acapsular atoxic version of the same strain, and to fraction I of Yersinia pestis. The specific activity of these preparations was studied in experiments on 80 capsular and 14 acapsular strains of plague microbe grown at 28 and 37°C. The first preparation agglutinated bacteria of the homologous type of typical and atypical acapsular strains in a concentration of 10<sup>7</sup> microbe cells/ml and higher. The activity of the second preparation was on the same level; however, the formation of finer agglutinate with incomplete clarification of the fluid was frequently observed. The third preparation detected only capsular versions of plague causative agent. The reaction was clearer with bacteria grown at 37°C, and its sensitivity reached 106 microbe cells/ml with selected strains. Only the third preparation possessed strict species specificity, whereas the first and second preparations also reacted with selected strains of pseudotuberculosis causative agent.

Several versions of group-specific cholera diagnosticums with various characteristics in relation to Vibrio cholerae 01 and non-01 were prepared. The rabbits were immunized by intravenous injection of suspensions of daily cultures of different strains of V. cholerae 01 subjected to prolonged boiling. Conditions to produce a highly specific preparation were selected. Reaction sensitivity ranged from 10<sup>6</sup> to 10<sup>8</sup> microbe cells/ml depending on the strain. Coagglutination was not observed with V. cholerae non-01. The diagnosticum's high specificity during identification of cultures isolated during the 1990 cholera outbreak was demonstrated.

To obtain a tularemia diagnosticum, animals were immunized with a 3x intravenous suspension of formalin-killed Francisella tularensis of the vaccine strain 15. In a study of five series of preparation using 96 strains of tularemia causative agent, including freshly isolated agent, the sensitivity of reaction with formalin-treated suspensions ranged from 10 to  $10^{-1}$  units based on standard turbidity and from 10 to  $10^{-2}$  units with boiling. With heterologous strains of different species of bacteria, no positive reaction was noted.

The antigen relationship of the causative agents of glanders and melioidosis and their serological cross-reactions make identification and differentiation of these bacteria difficult. Immune sera obtained to corpuscular antigens of each of the species agglutinated bacteria of both species. Cross-reactions were successfully eliminated by adsorbing melioidosis serum with glanders antigen, whereas depletion of glanders serum by melioidosis bacteria resulted in a loss of its activity. The melioidosis diagnosticum thus acquired strict species specificity, whereas the glanders diagnosticum agglutinated bacteria of both homologous strains and most strains of melioidosis causative agent. The reaction's sensitivity ranged from 10<sup>7</sup> to 10<sup>9</sup> microbe cells/ml. Simultaneous use of the two diagnosticums during serologic identification of

the causative agents of melioidosis and glanders makes it possible to differentiate the species.

In a study of the reaction of coagglutination of individual colonies grown on dense culture media or elective colonies with seeding of pure or mixed cultures, the diagnosticums clearly detected the respective colonies, which permitted rapid serologic identification and a reduction in analysis time. In a study of coagglutination reactions, the biological material of animals containing tularemia causative agent were subjected to boiling and centrifugation. This eliminated nonspecific reactions, and in all cases, tularemia antigen was detected in a suspension of the organs of animals that had died after infection. The tularemia diagnosticum was used in studying field material during epizooty of this infection. The positive results in the coagglutination reaction were always confirmed by isolating cultures. No false-positive reactions were observed. The possibility of detecting cholera vibrios in feces and the possibility of detecting the causative agents of glanders and melioidosis in mixed cultures after enrichment of the material on elective media were demonstrated under experimental conditions.

The set of dry coagglutinating diagnosticums consisting of plague, tularemia, cholera, glanders, and melioidosis preparations that was developed may be recommended for identifying cultures, screening colonies, and detecting causative agents in biological material and in an external medium during an accelerated analysis process, as well as in quick analysis.

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# Nonpedigree Mice—Bioproducers of Monoclonal Antibodies to Capsular Plague Microbe Antigen

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[Article by Z.L. Devdariani, V.A. Fedorova, M.S. Verenkov, A.I. Chizhinkov, and A.Kh. Kochetov, Mikrob Antiplague Scientific Research Institute, Saratov; UDC 616.985:579.843.94]-07:616.163.962.40-097-078.33]-092.9]

[Text] Syngeneic mice of BALB/c lineage infected with production strains of hybridoma cells are the source of the specific raw material used in the production of the commercial diagnostic plague monoclonal anticapsular luminescing immmunoglobulins developed at the Mikrob All-Russia Antiplague Scientific Research Institute.

In conjunction with the unique conditions of raising and breeding mice of specific lineage and likely probability of loss of the animals' homozygoticity when their breeding expanded, we tried to use the most popular nonpedigree albino mice in order to produce ascitic fluid containing specific monoclonal antibodies.

One hundred fifty nonpedigree albino mice and 525 BALB/c mice obtained from the Mikrob institute's nursery were infected with the production strain of hybridoma Jp.FI.D<sub>3</sub>.B<sub>2</sub>.Sp. The mice ranged from 18 to 25 g in weight and 2 to 6 months in age. One to 5 weeks before infection, they were given intraperitoneal injections of the mineral oil pristane (Sigma, United States) in the amount of 0.5 ml.

The specific activity of the ascitic fluid was determined through a reaction of indirect hemagglutination with commercial plague erythrocytic antigen diagnosticum manufactured at the Central Asia Antiplague Institute (Alma-Ata) and through the indirect method of fluorescing antibodies (by using luminescing serum) to albino mouse globulins produced by the Epidemiology and Microbiology Scientific Research Institute imeni N.F. Gamaley of the USSR Academy of Medical Sciences in Moscow.

Three groups of nonpedigree mice that each contained different numbers of hybridoma-inoculated cells (1-5, 5-10, and 10-15 million, respectively) were formed to study the efficiency of antibody formation. The number of passages of the hybridoma cells in the different groups of animals ranged from 3-4 to 6-8. It was established that the number of mice with an ascitic tumor in each of the different groups was approximately identical. Of the 150 nonpedigree mice used in the experiments, 78 (52.0 +/-4.1 percent) were found to have an ascitic tumor. The time to autopsy of the animals amounted to 9.3 +/- 0.4 days, the volume of ascites amounted to 3.7 + -0.3 ml. and the concentration of hybridoma cells equaled 14.5 +/- 1.8 million/ml. The volume of ascitic fluid obtained per mouse fluctuated from 0.5 to 13 ml, and the concentration of cells ranged from 500,000 to 75 million/ml. A total of 25 mice (16.6 +/- 3.0 percent) died, 17 (11.3 +/-2.6 percent) were found to be free of symptoms of ascitic tumor, and 55 (36.6 +/- 3.9 percent) survived after infection. There were no statistically significant differences with respect to the number of mice with ascites and the concentration of hybridoma cells in the ascitic fluid as a function of the infecting dose of hybridoma. Ascitic tumor formation took longer in the mice infected with 1-5 million hybridoma cells. The average volume of ascitic fluid obtained from one mouse was significantly lower (p < 0.05) in the group of animals treated with higher doses of hybridoma.

When the animals were divided into two groups based on passages performed, a statistically significant difference (p < 0.01) was found with respect to the number of ascitic mice in the group of animals infected with hybridoma after 3-5 passages (66.0 + /- 4.7 percent) compared with the group infected after 6-8 passages (26.0 + /- 6.2 + .- 6.2

percent). From the first group of mice, 227.3 ml of ascitic fluid was obtained, and from the second group, 31.7 ml was obtained. The average volume of ascitic fluid obtained from one mouse was significantly lower (p <0.05) in the second group of animals. The increased efficiency of ascites formation in the animals with an elevated infecting dose of hybridoma after 6-8 passages should also be noted. For comparison, ascitic tumor was recorded in 480 (91.4 +/- 2.4 million/ml) of the 525 BALB/c mice infected with the very same hybridoma in doses of 1-5 million cells after 2-12 passages. The ascites formation time averaged 7 +/- 0.1 days, the volume of ascitic fluid amounted to 7.1 +/- 0.1 ml, and the concentration of hybridoma cells equaled 12.4 +/- 2.4 million/ ml. The results obtained with respect to the latter two indicators were virtually no different from the respective data for the group of nonpedigree mice.

After 10-12 intertwinings of the hybridoma Jp.FI.D<sub>3</sub>.B<sub>2</sub>.Sp in the bodies of the nonpedigree mice, it was virtually impossible to obtain ascitic tumors despite the injection of high infecting doses (10-20 million cells). The animals generally survived or yielded single solid tumors. The efficiency of ascites formation in mice of the BALB/c line remained high (80-88 percent) up to the 33rd passage (the observation period).

The specific activity of the ascitic fluid obtained from the nonpedigree mice and the mice of BALB/c lineage were at the same level in the indirect hemagglutination reaction and when the indirect method of fluorescing antibodies was used. From the standpoint of its physicochemical properties and specific activity (working dilution of at least 1:32), the commercial luminescing preparation prepared on the basis of biological material from nonpedigree mice conformed to the requirements stipulated in technical norm references (Experimental-production Regulation No. 11-86 and Temporary Pharmacopoeia Article 42-66VS-87).

It was thus established that nonpedigree mice may be used as a source of monoclonal antibodies to capsular plague microbe antigen when they are infected with the hybridoma Jp.FI.D<sub>3</sub>.B<sub>2</sub>.Sp and that the efficiency of ascites formation decreases as the number of passages of the hybridoma cells in the bodies of nonpedigree mice increases. This is possibly a unique property of the specific hybridoma. It should be noted that the hybridoma used in this work was obtained in 1983. During the 7 years that followed, it was cloned several times and passaged numerous times during the process of scientific studies, scientific-technical development, and commercial production of the preparation on BALB/c mice that were acquired from various sources and that often were of dubious genetic standard. It may be hypothesized that a partial selection of cells with weakly expressed antigen properties

and capable of adaptation in nonsyngeneic mice occurred a result of periodic culturing of the hybridoma Jp.FI.D<sub>3</sub>.B<sub>2</sub>.Sp on genetically impure animals.

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#### PHARMACOLOGY AND PHYSIOLOGY

# Effect of Liposomal Lipid Peroxidation Products on Liposomes' Antibacterial Activity

947C0099A Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol. 37 No. 11, Nov 92 pp 8-10

[Article by L.P. Melyantseva, V.M. Kreynes, T.I. Shrayer, T.I. Lagunova, I.M. Ulyantseva, Khirurgiya Surgery Enterprise, Kemerovo]

[Abstract] The ability of phosphatidyl-cholinecholesteric liposomes to suppress the growth of conditionally pathogenic microorganism and nonenzymatic self-oxidation of liposomal lipids which is facilitated by ultrasonic treatment and is accompanied by the formation of malonic dialdehyde (MDA) are discussed, and it is noted that the lipid peroxidation products (POL) are strong oxidants with a damaging effect on cell membranes. An attempt is made to investigate the accumulation of secondary lipid peroxidation products in liposomal and liposomal-bacterial suspensions and to study their effect on the growth of the Pseudomonas aeruginosa culture. To this end, liposomes are prepared from egg phosphatidyl-choline (by BIOS, Novosibirsk) and cholesterol (by Sigma, U.S.) in a 7:5 molar ratio and a 25 mg/ml lipid concentration in a 01.15 M NaCl solution with subsequent ultrasonic treatment at 22 kHz. The Pseudomonas aeruginosa 2134 strain is used as the test culture. The dynamics of malonic dialdehyde accumulation in liposomal suspensions with various pH values, the malonic dialdehyde accumulation dynamics in the liposomal-bacterial suspension containing Pseudomonas aeruginosa cells with various pH values, and the dependence of the Pseudomonas aeruginosa cell growth on the level of lipid peroxidation product accumulation in the liposome suspension are plotted. The findings demonstrate that during 24 h of liposome incubation at a 37°C temperature, lipid peroxidation products are accumulated in the suspension while the accumulation dynamics in the liposomal suspension differ from their accumulation rate in the liposomal-bacterial suspension whereby the process intensity depends on the medium acidity. The lipid peroxidation products display a bactericide effect whose manifestation depends on the extent of lipid peroxidation product accumulation, liposome concentration, and exposure duration. Figures 3; tables 1; references 11: 10 Russian, 1 Western.

# Genes of Resistance to Aminoglycoside Antibiotics of Serratia Marcescens Clinical Strains and Enzymes Encoded by Them

947C0099B Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol. 37 No. 11, Nov 92 pp 10-14

[Article by A.N. Kolganov, S.B. Vakulenko, National Antibiotics Research Center, Moscow]

[Abstract] The mechanism of clinical enterobacteria strain resistance to aminoglycoside antibiotics due to the antibiotics modification by three types of enzymes is discussed, and it is stressed that despite the great diversity of enterobacteria's aminoglycoresistance genes, three-to-four different types of encoding enzymes are predominant among clinical isolates. Consequently, an attempt is made to determine the types of enzymes produced by Serratia marcescens strains which inactivate aminoglycoside antibiotics and to identify the genes which encode them. To this end, 31 aminoglycoside antibiotic resistant strains of Serratia marcescens isolated by mid-1908s are used. The experimental procedure and the components used are outlined in detail. The study of the clinical isolates' sensitivity to a number of aminoglycoside antibiotics did not reveal strains which are highly resistant to amikacin yet the microorganisms' levels of sensitivity to this antibiotic varied within 0.5-8 µg/ml. The diameters of the micro-organism growth suppression zones and types of aminoglycoside activating enzymes determined by two methods are summarized, and the conclusion is drawn that DNA-DNA hybridization is a reliable method of determining the presence of the specific resistance genes which makes it possible to identify silent genes which cannot be detected by the AGRP method; the latter, however, is suitable for reliably determining the types of aminoglycoside activating enzymes provided that the strains do not contain genes which code the enzymes with overlapping resistance spectra. Thus, 85% of the strains under study contain other genes encoding aminoglycoside activating enzymes in addition to the gene encoding the AAC(6')-Ic aminoglycosideacetyltransferase; this makes these strains resistant to a broad range of aminoglycoside antibiotics. Tables 1; references 5: 2 Russian, 3 Western.

#### Effect of Antibiotics on Francisella Tularensis

947C0099C Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol. 37 No. 11, Nov 92 pp 14-17

[Article by S.V. Sidorenko, I.K. Lebedeva, S.I. Dyakov, V.A. Zakharov, National Antibiotics Research Center, Moscow, and Scientific Research Institute of Military Medicine, St. Petersburg]

[Abstract] The endemic rate of tularemia in many regions of the northern hemisphere, especially among rodents and even humans, and the resistance of *Francisella tularensis* to betalactam and other antibiotics

prompted an examination of the inhibitory and bactericide activity of representatives of various antibiotics and chemical preparation classes to tularemia bacteria and an attempt to assess their interaction. The strains used in the experiment and their cultivation procedure, the antibiotics used, the measurement of the minimum inhibitory concentration (MPK), the study of the postantibiotic effect (PAE), a study of the bactericide activity, and statistical processing using the Statgrafics program are described in detail. Student's t-test was also used to assess the confidence of data. The minimum inhibitory concentration of the antibiotics and chemical preparations (in µg/ml( relative to various Francisella tularensis strains, and interaction of the antibiotics combinations relative to various Francisella tularensis strains, and the antibiotics' bactericide activity relative to the Francisella tularensis are summarized, and the optical density of the culture after treatment with various sisomycin concentrations is plotted. The growth rate of the Francisella tularensis Schu-S4 strain after treatment with various antibacterial preparation concentrations (doxycyclin, rifampicin, sisomycin, and ciprofloxacin) is calculated for the 0-6 and 6-24 h time intervals. The findings indicate that with respect to the inhibitory and bactericide action and post-antibiotic effect manifestation, aminoglycoside antibiotics and fluoridated quinolons (sisomycin and ciprofloxacin) have the highest activity toward tularemia bacteria while doxycyclin, rifampicin, and phosnodemycin have a pronounced inhibitory activity toward tularemia bacteria but display no bactericide activity; their postantibiotic effect is manifested to a lesser extent than that of sisomycin and ciprofloxacin. Figures 1; tables 4; references 13: 6 Russian, 7 Western.

#### Drug Resistance Dynamics of Vibrio Cholerae Isolated From Siberian and Far Eastern Surface Reservoirs in 1976-1990

947C0099D Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol. 37 No. 11, Nov 92 pp 17-21

[Article by V.S. Ganin, A.F. Pinigin, Irkutsk Scientific Research Antiplague Institute of Siberia and Far East]

[Abstract] The proliferation of ant. sistant strains due to wide uses of antibiotics in infectious disease therapy and as fodder additives for agricultural livestock and the observed variability in the strains' resistance to chemotherapy preparations prompted an investigation into the stability of Vibrio comma isolated from the water of surface reservoirs in the Far East in Siberia in the past 15 years to antibiotics. To this end, 1,383 El Tor strains isolated from 12 administrative regions (from Amur to Tyumen and from Yakutia Sakha to Buryatia) are tested for their resistance to eight antibiotics: ampicillin, streptomycin, monomycin, polymyxin, tetracycline, chloramphenicol, rifampicin, and nalidixic acid. The findings do not display a common tendency toward increasing the resistance but confirm the observed variability, especially for Ap, Sm, Mn, and Pm. Of these, most strains are

resistant to Pm, Ap, and Sm (up to 100% in some years) and the least number are resistant to Cm and Tc (0.4 and 1.9%, respectively); in some cases a geographic correlation is established. In addition, a direct quantitative dependence of the resistance level on the minimum inhibitory concentration is revealed: the lower the the minimum inhibitory concentration, the fewer the number of resistant strains. The findings may be used for comparative retrospective analyses of the antibiotic resistance of *Vibrio cholerae* isolated in different regions and for solving certain epidemiological problems. Figures 1; tables 2; references 12.

# Effect of Subinhibitory Antibiotic Concentrations on Plague Microbe's Catalase Activity

947C0099E Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol. 37 No. 11, Nov 92 pp 21-23

[Article by V.V. Ryzhkova, N.S. Blagorodova, R.V. Mikhalevich, N.V. Pavlovich, Scientific Research Antiplague Institute, Rostov-na-Donu]

[Abstract] The ability of the bacterial catalase to break up hydrogen peroxide forming during the "respiratory explosion" thus facilitating the microbe survival in the sensitive macro-organism and the fact that the plague microbe has a high catalase activity as well as reports that antibacterial preparations affect not only known microbial cell targets but also the factors which are important for revealing the pathogenic properties of the stimulants prompted a study of the effect of sub-inhibitory concentrations of various groups of antibiotics on the catalase activity of the plague microbe. To this end, two strains of plague microbe-one vaccinal (Yersinia pestis EV1290) and one virulent (Yersinia pestis 1300)—are used in an experiment in which the strain sensitivity to antibacterial preparations is measured by a series of dilutions in LB agar. Systematic data processing is carried out by Boyarskiy's method at a confidence interval  $I_{0.5}$  for p=0.05. The plague microbe cell sensitivity to such antibacterial preparations as ampicillin, cefaxime, gentamycin, streptomycin, rifampicin, doxycyclin, and polymyxin B, the effect of their subinhibitory concentrations at various temperatures on the catalase activity, and the effect of their subinhibitory concentrations on the virulence of Yersinia pestis 1300 are summarized. The study reveals that introduction of subinhibitory concentrations of ampicillin, cefotaxime, or gentamycin to the cultivation medium leads to a significant decrease in the catalase activity of the plague microbe and that virulent Yersinia pestis 1300 strain cells grown at a 37°C temperature in the presence of sub-inhibitory concentrations of ampicillin or cefotaxime have a lower ability to cause the death of laboratory animals. Tables 3; references 9: 4 Russian, 5 Western.

#### Antibiotic Sensitivity of Plague Microbe Strains From Foreign Countries

947C0099F Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol. 37 No. 11, Nov 92 pp 23-24

[Article by G.N. Galenko, A.K. Akiyev, V.Ye. Tarasova, Scientific Research Antiplague Institute of the Caucasus and Trans-Caucasus, Stavropol]

[Abstract] The scientific and practical importance of data on the interaction of plague microbes with antibiotics obtained in experiments with strains isolated from natural disease outbreaks prompted an investigation of 50 foreign strains from the persons infected with plague. The strains for this purpose were received from the Plague Scientific Research and Information Center in Stavropol in cooperation with the World Health Organization. All strains are isolated from the patients whose disease is clinically manifested in the cutaneous bubonic and septicemic forms. In addition, five plague microbe strains isolated from an outbreak in Central Caucasus as well as control strains recommended by WHO-Pseudomonas aeruginosa ATCC 27853, Escherichia coli 25922, and Staphylococcus aureus 25923—were included in the experiment. In examining the U.S. strains, streptomycin, gentamycin, ristomycin, kanamycin, doxycyclin, and polymyxin C were used. The resistance of African strains to a broad range of antibiotics, including streptomycin, erythromycin, monomycin, and lincomycin was also examined. The outcome of the experiment was assessed after 48 h of incubation at a 28°C temperature. The sensitivity of U.S. and African strains of plague microbe to the above antibiotics is summarized; the standard strain sensitivity was consistent with WHO guidelines. The experiment makes it possible to assert that the plague microbe strains isolated from patients treated with large doses of antibiotics (usually streptomycin) display no appreciably noticeable tendency toward developing resistance to them. It is noted that in addition to streptomycin, gentamycin, doxycyclin, kanamycin, and tetracycline warrant further investigation. Tables 1; references 7: 5 Russian, 2 Western.

Cefotaxime Efficacy in Experimental Plague Infection 947C0099G Moscow ANTIBIOTIKI I

KHIMIOTERAPIYA in Russian Vol. 37 No. 11, Nov 92 pp 24-26

[Article by L.N. Makarovskaya, A.I. Shcherbanyuk, I.V. Kasatkina, V.A. Zurabyan, Antiplague Scientific Research Institute, Rostov-na-Donu]

[Abstract] The value of third generation cephalosporins, particularly third generation cefotaxime which is distinguished from first and second generation preparations by improved pharmacological properties, a broader impact spectrum, and a higher activity to gram-negative bacteria, especially Enterobacteriaceae which are resistant to various first and second generation antibiotics, prompted an attempt to assess cefotaxime from the viewpoint of its activity relative to the plague microbe in an in vitro experiment with an experimental plague infection and to investigate the possibility of its joint use with other antibiotics. To this end, cefotaxime synthesized in Russia, a preparation developed by Servo Mihal (Yugoslavia), and amikacin (U.S.) are used in an experiment with albino mice. The antibiotic minimum inhibitory concentration relative to the plague microbe strains is determined in Hottinger's agar while the efficiency of cefotaxime and its combinations with amikacin is examined in mice infected with a suspension of Yersinia pestis 231 whereby cefotaxime was injected intramuscularly. The outcome of combined application of cefotaxime with amikacin in prevention of experimental plague in albino mice is summarized. The findings reveal that cefotaxime—a representative of third generation cephalosporines—has a 0.05-0.1 µg/ml minimum inhibitory concentration for natural plague microbe strains compared to first generation cefazolin and cephalothin and second generation cefmethazole, i.e., is the lowest, thus confirming its high efficiency in the prevention and treatment of experimental plague in albino mice. The results demonstrate the possibility of combined uses of cefotaxime and amikacin for plague infection prevention and treatment. Tables 3; references 7: 3 Russian, 4 Western.

#### Doxycyclin in Preventing Experimental Plague Induced by Agent Strain Versions

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[Article by E.D. Samokhodkina, I.V. Ryzhko, A.I. Shcherbanyuk, I.V. Kasatkina. R.I. Tsurayeva, T.A. Zhigalova, Antiplague Scientific Research Institute, Rostovna-Donu]

[Abstract] The scarcity of data on the efficacy of antibiotics against an agent form incapable of producing a capsular antigen (fraction I) or agent versions with the Fra' phenotype which are isolated in exotic foci and can induce disease in humans necessitated a study of the preventive action of tetracyclines, primarily doxycyclin, against the plague infection induced by a fractionless agent version. To this end, the Yersinia pestis 231 (708) strain and its

fractionless versions 231 Fra.1 and Fra.2 are used whereby 18-20 g albino mice are subcutaneously infected with suspensions of agar cultures. The plague microbe strain's sensitivity to tetracylines is determined in vitro. The efficacy of doxycyclin and tetracycline in the prevention of experimental albino mice plague induced by a 100 µg/kg injected dose of Y. pestis 231 and 231 Fra, a comparative analysis of the ED<sub>50</sub> values for doxycyclin against experimental plague in albino mice infected with Y. pestis 231 and 231 Fra ( $\approx 1,000 \text{ LD}_{50}$ ) by injection, and the preventive efficacy of injected doxycyclin against experimental albino mice plague induced by Y. pestis 231 and 231 Fra (≈1,000 LD<sub>50</sub>) are summarized. The study shows that neither an increase in the daily dose, nor an increase in the treatment duration ensured a high preventive treatment efficiency against fractionless plague agent versions, probably due to a change in the infectious process development. The conclusion is drawn that doxycyclin—a prolonged semi-synthetic tetracycline preparation—has a lower therapeutic efficiency against experimental plague in albino mice induced by a strain deprived of the ability to produce fraction I; this is manifested by higher ED<sub>so</sub> values and lower LD50 values of this preparation against the backdrop of treatment and a lower percentage of animals surviving after intensive antibiotic therapy. The importance of taking into account the possibility of a decrease in the tetracycline efficiency for an infection induced by a fractionless agent version in developing treatment and prevention procedures is stressed. Tables 3; references 10: 6 Russian, 4 Western.

#### Study of Efficacy of Phosphomycin and its Combinations With Amikacin and Cefotaxime Against Experimental Plague Infection

947C0099I Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol. 37 No. 11, Nov 92 pp 29-30

[Article by A.I. Shcherbanyuk, I.V. Kasatkina, L.N. Makarovskaya, Antiplague Scientific Research Institute, Rostov-na-Donu]

[Abstract] A lack of data on the efficacy of phosphomycin—a phosphonic acid group antibiotic with a bactericide effect against the Escherichia coli, Proteus mirabilis, Psedomonas aeruginosa, Serratia marcescens, Shigella spp., Salmonella spp., Vibrio cholerae, etc., strainsprompted a study of the efficacy of this drug and its combinations with other antibiotics in treating experimental plague in albino mice. To this end, mice were infected subcutaneously with a 1,250 LD<sub>50</sub> dose of the suspension of day-old Yersinia pestis 231 agar culture. Phosphomycin was injected 24 h after infection once a day for seven days in the amount of 2, 4, 8, and 16 g per mouse. The efficacy of the single antibiotic and its combinations with amikacin or cefotaxime was assessed using deliberately inadequate doses. In addition, phosphomycin and amikacin was administered alternately for four days. The efficacy of combined application of phosphomycin and amikacin or cefotaxime for experimental plague treatment in albino mice is summarized.

The experiment reveals that phosphomycin is a highly efficient preparation for treating experimental plague in albino mice and demonstrates the possibility of its combined use with either of the two other antibiotics. Tables 1; references 10: 3 Russian, 7 Western.

# Detoxicating Effect of Antibiotics on Their Efficacy Against Experimental Plague at Pronounced Intoxication Stage

947C0099J Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol. 37 No. 11, Nov 92 pp 30-32

[Article by L.N. Makarovskaya, Ye.V. Glyanko, L.A. Tinker, Yu.A. Kasatkin, V.V. Ryzhkova, N.V. Bozhko, L.A. Kozyreva, Antiplague Scientific Research Institute, Rostov-na-Donu]

[Abstract] The declining efficacy of antibiotics at the late stages of plague, especially at the stages of marked intoxication, necessitated a study of the detoxicating action of antibiotics and their efficacy during the marked intoxication stage of experimental plague. To this end, an experiment is carried out on 18-20 g albino mice and 250-300 g guinea pigs infected with plague by injecting them with a mixture of fraction II of the plague microbe (according to Baker) and plague microbe's lipopolysachharide (LPS) obtained by Westphal's method. The joint toxicity of these two agents was examined. The plague infection was experimentally induced by subcutaneous injection of the Yersinia pestis 231 virulent strain, and treatment began 48 h after infection for mice and 72 h-for guinea pigs. Statistical data processing involved an assessment of the confidence of various relative survival indices of mice in experimental and control groups. The detoxicating activity of polymyxin B relative to the plague microbe toxin and the efficacy of a combination of anubiotics in starting treatment of experimental plague in albino mice 48 h after infection are summarized. The study shows that polymyxin has a detoxicating effect and facilitates albino mice survival at the early plague intoxication stage; this is attributed to the ability of polymyxin B to inhibit the biological activity of lipopolysachharide in the external membrane of gram-negative bacteria. The use of a single antibiotic, such as amikacin, rifampicin, doxycyclin, or cefotaxime, which are efficient at the early treatment against the background of polymyxin therapy at the stage of marked infection generalization increases the animal survivability compared to the individual use of each preparation. As for the guinea pigs at the same stage of disease, a certain therapeutic effect is observed under the combined use of gentamycin with trenthal or dipromonium whereby the life span and survival of individual animals increase. The conclusion is drawn that the proposed treatment is promising for comprehensive treatment of generalized plague infection and is capable of increasing the therapy efficacy. Tables 2; references 4: 2 Russian, 2 Western.

# LASER AND NONIONIZING RADIATION

### Bioanalytical Applications of Firefly Luciferase: Review

947C0095A Moscow PRIKLADNAYA BIOKHIMIYA I MIKROBIOLOGIYA in Russian Vol. 29 No. 2, Mar-Apr 93 pp 180-192

[Article by N.N. Ugarova, Moscow State University; UDC 577.158.54:579.8.04]

[Abstract] The unique properties of firefly luciferase—an enzyme which catalyzes luciferin's organic substrate oxidation by atmospheric oxygen in the presence of adenosine-5'-triphosphate (ATF) and magnesium ionswhich is almost absolutely specific to both luciferin and ATP prompted an examination of the underlying principles of bioluminescent microanalysis using firefly luciferase. Numerous published data and the outcome of the author's own lab research into the use of luciferase in microbiology, clinical biochemistry, and proximate analysis of the materials' antibiotic sensitivity and resistance to biologically-induced corrosion are outlined. The principal characteristics of two ATP-reagents (microlum and immolum), the measurement ranges of enzyme and metabolite trace amounts using firefly luciferase, the ATP, PNM, and gemine content in various biological materials, and the microflora sensitivity to the effect of antibiotics are summarized. The light signal at various ATP concentrations for the immolum agent, calibration curves for detecting the ADP nucleotide, calibration curves for detecting biomass in various cultures, ATP concentration curves in measurements of the microflora sensitivity to antibiotics, and the calibration curve for detecting the \(\beta\)-galactosidade by the bioluminescent method are plotted. New approaches to using luciferase for detecting marker enzymes in enzymatic immunoassay analysis and nonradioactive detection of DNA samples are considered. Basic research and the development of enzyme stabilization and immobilization methods as well as the development of analytical procedures of luciferase applications open up new opportunities for bioluminescent methods in analytical and clinical biochemistry labs and in environmental and microbiological monitoring. Figures 9; tables 4; references 14: 11 Russian, 3 Western.

#### Acetophenone Biodegradation by Soil Bacteria

947C0095B Moscow PRIKLADNAYA BIOKHIMIYA I MIKROBIOLOGIYA in Russian Vol. 29 No. 2, Mar-Apr 93 pp 218-222

[Article by A.Yu. Fedorov, Ye.V. Volchenko, V.Yu. Krestyaninov, V.I. Korzhenevich, Saratov Branch of the National Scientific Research Institute of Commercial Microorganism Genetics and Selection; UDC 579.695:574.635]

[Abstract] The urgency of removing acetophenone (AF), also known as methylphenylketone or hypnone, an aromatic substance present in waste water of acetone and phenol production by the cumene method, from the environment due to its toxicity, and known advantages of biological treatment methods, e.g., with the help of the Nocardia and Arthrobacter strains, prompted attempts to isolate acetophenone-destroying strains from natural environmental entities, and select and choose the most active strains capable of utilizing acetophenone both in mineral media and real waste water samples. The acetophenone-destructor strains were isolated by a conventional procedure of direct soil suspension inoculation on an agar-treated mineral M9 medium containing acetophenone as a sole carbon source. The experimental procedure is outlined. The acetophenone-destructor strains were tested in waste water assays in 250 ml bulbs with 100 ml of waste water at a 107 c/ml inoculation density. The component concentration was measured by gas chromatography and spectrophotometry methods. Six strains capable of growing in agarized mineral media with a 500 mg/l acetophenone concentration as a sole carbon source were isolated from the 38 samples taken from phenol-producing enterprises. One was identified as Azomonas macrocytogenes No. 139 and one-as Pseudomonas putida No. 8. The remaining strains were nonpathogenic gram-negative bacilli. The isolated strains were capable of utilizing acetophenone in an up to 500 mg/l concentration; as a result of selection, they improved their ability to degrade this substrate in a 625 to 1,250 mg/l concentration in 96-120 h. The substrate utilization and biomass accumulation dynamics during acetophenone biodestruction by strain No. 8 of Pseudomonas putida as a function of its concentration is plotted. After total utilization of the toxic substrate by the strain, the culturing liquid was less toxic than the initial acetophenone solution for a number of test microorganisms. In the authors' opinion, the isolated cultures are quite promising for microbiological waste water treatment. Figures 1; tables 1; references 13: 8 Russian, 5 Western.

# Lignocellulolytic Activity of Pleurotus Ostreatus IBK-191 in Solid Phase Fermentation of Tea Production Waste

947C0095C Moscow PRIKLADNAYA BIOKHIMIYA I MIKROBIOLOGIYA in Russian Vol. 29 No. 2, Mar-Apr 93 pp 227-232

[Article by N.G. Kokhreidze, V.I. Elisashvili, Plant Biochemistry Institute of Georgian Republic's Academy of Sciences, Tbilisi; UDC 577.15]

[Abstract] The ability of higher basidial fungi to degrade all plant biomass biopolymers, including lignin, due to their broad range of hydrolytic and oxidizing enzymes and mycelium's capacity to penetrate the substrate make basidiomycetes promising for bioconversion of plant materials despite their slow growth. An attempt is made to confirm the possibility of bioconversion of tea production waste by higher basidiomycetes in order to obtain a fungal protein and a complex of lignocellulolytic enzymes. To this end, higher basidial fungi from the Botanical Institute collection in St. Petersburg and Plant Biochemistry Institute of Georgian Republic's Academy of Sciences were examined. Solid phase fermentation (TFF) was carried out at 27° in 100 ml bulbs containing 4 g (dry residue) of tea production waste. The experimental procedure is outlined. The protein concentration in the biomass was measured by Kjeldahl's method and the laccase activity was determined by the oxidation of syringaldazine, and the Mn-dependent peroxidase activity was measured ny the NADN oxidation. The true protein concentration in the solid phase tea substrate fermentation products was determined: it exceeded 18% after 2 weeks of fungal growth in such basidiomycete cultures as Cerrena unicolor 062, Cerrena maxima 0681, Coriolus hirsutus IBR-11, and Pleurotus ostreatus IBK-191. The true protein concentration and the xylanase and cellulase activity of higher basidiomycetes in solid phase fermentation of the tea substrate, laccase and Mn-peroxidase activity of basidiomycetes in solid phase fermentation, and true protein concentration and fermentation activity of P. ostreatus IBK-191 as a function of the nitrogen source in solid phase fermentation are summarized, and the growth and fermentation activity dynamics of the P. ostreatus IBK-191 substrate in solid state fermentation are plotted. The C. unicolor 062 culture displays the highest cellulase and xylanase activity (158.5 and 114.7 units/g, respectively) while the Coriolus hirsutus IBR-11 has the highest laccase activity (4.7). P. ostreatus IBK-191 has the highest Mndependent peroxidase activity (5.5). Substantial differences in the activity dynamics of the enzymes are discovered. Organic nitrogen sources stimulate the xylanase and laccase production while KNO3 sources stimulate the carboxymethylcellulase and Mn-dependent peroxidase production by the P. ostreatus IBK-191 culture. Bioconversion may be used to produce protein-enriched edible fungus products and plant feed products as well as a range of lignocellulolytic enzymes. Figures 1; tables 3; references 21: 9 Russian, 12 Western.

#### Impact of Microbial Proteases on Plant Raw Material Conversion Efficiency in Lysine Production

947C0095D Moscow PRIKLADNAYA BIOKHIMIYA I MIKROBIOLOGIYA in Russian Vol. 29 No. 2, Mar-Apr 93 pp 271-279

[Article by L.V. Rimareva, M.B. Overchenko, T.B. Milyukova, V.V. Trifonova, N.I. Ignatova, A.S. Tikhomirova, National Scientific Research Institute of Food Biotechnology, Moscow; UDC 577.156:664.2.03: 668.394]

[Abstract] The outlook for developing new methods of bioconversion of various types of agricultural products for the purpose of lysine production, thus making it possible greatly to expand its raw material production base, and the possibility of increasing the carbon-lysine bioconversion vield and improving the synthesis efficiency as well as saving the consumption of plant substances necessary for lysine producers, e.g. Brevibacteria, prompted a study of the effect of proteases with a varying action specificity on the plant protein proteolysis degree and subsequent substrate bioconversion by lysine-producing bacteria. To this end, the Brevibacteria sp. lysine-producer is cultivated in 750 ml bulbs containing 25-30 ml of nutrient medium in a circular rocker spinning at a 220-240 RPM speed for 66-72 h at a 30° temperature. The nutrient medium preparation, experimental procedure, and carbohydrate concentration

measurement methods are outlined. The total amount of amino acids formed as a result of proteolysis is used as the basic indicator of the proteolytic preparation suitability for plant raw material conversion. Fungal protease from Aspergillus oryzae 251-90 (G10kh) and bacterial protease from Bacillus subtilis G10kh which have the necessary proteolytic activity level for animal proteins within a 4.7-5.3 pH range are used for comparative characterization. The A. oryzae 251-90 proteolytic enzymes containing a highly active protease complex are the most active. The behavior of amine nitrogen concentration in nutrient media under the effect of proteolytic enzymes and the utilization efficiency of the resulting hydrolysates in lysine biosynthesis by the Brevibacteria sp. culture, the effect of A. oryzae 251-90 proteases on the amino acid composition of the plant nutrient medium, the protein amino acid content in the Brevibacteria sp. culturing liquid in various media, the free amino acid concentration in the culturing liquid during the growth of Brevibacteria sp., and the growth amino acid concentration in the nutrient media are summarized. The growth, carbohydrate consumption, and lysine accumulation dynamics are plotted. The A. oryzae 251-90 fungal proteolytic enzymes also indirectly but significantly affect the lysine-producing bacteria's biosynthetic activity. Nutrient medium enrichment with wellmetabolized amine nitrogen increases the bioconversion efficacy of cereal and root tuber raw materials and intensifies lysine and protein biosynthesis and bacteria accumulation. Figures 2; tables 5; references 11.

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